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Monterey, California: Naval Postgraduate School

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

**A DECOMPOSITION ANALYSIS OF
FIRST-TERM ATTRITION IN THE U.S. MILITARY**

by

Haluk Elis

September 1999

Thesis Co-Advisors: Stephen L. Mehay
                                                       Mike Cook

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19991129 004

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE September 1999	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE A DECOMPOSITION ANALYSIS OF FIRST-TERM ATTRITION IN THE U.S. MILITARY	5. FUNDING NUMBERS
6. AUTHOR Elis, Haluk	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE

13. ABSTRACT (maximum 200 words)

This thesis analyzes causal factors associated with first-term attrition for all four military services. In particular, it seeks to identify demographic and other factors that have influenced changes in attrition over time. The thesis draws on data provided by the Defense Manpower Data Center on entry cohorts for fiscal years 1984, 1989, and 1994. Separate multivariate models are estimated for each service and each year. These models are used to implement a decomposition analysis of the changes in attrition between 1984 and 1989, between 1989 and 1994 and between 1984 and 1994. The decomposition technique analyzes the portion of the changes in attrition over these periods that is attributable to changes in the demographic composition of the entry cohorts and the portion due to changes in the estimated model coefficients.

The thesis finds that sex, education, race, AFQT scores, and months spent in Delayed Entry Program consistently affect attrition behavior while the relationship between age at entry and attrition is not clear. The decomposition technique used in the thesis finds that there are generally big differences between the predicted and the actual changes in attrition and that the direction of predicted and actual change is generally in opposite directions. The thesis recommends that the role of other factors, such as service-specific policies be researched to keep attrition from further rising and that the decomposition technique be replicated for other beginning and end points.

14. SUBJECT TERMS First-term Attrition, Multivariate Logit Models, Decomposition Technique			15. NUMBER OF PAGES 149
			16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

i

A DECOMPOSITION ANALYSIS OF
FIRST-TERM ATTRITION IN THE U.S. MILITARY

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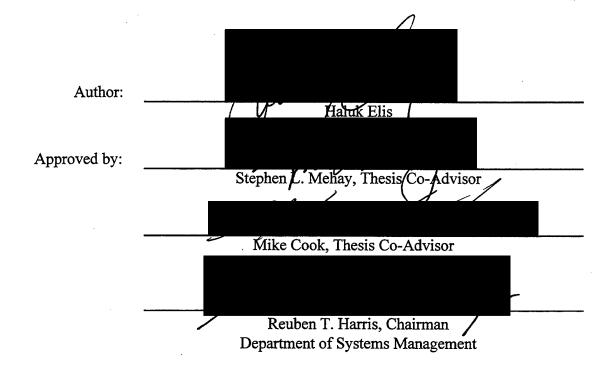B.S., Turkish Army Academy, Ankara, 1993

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
September 1999

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iii

ABSTRACT

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The thesis finds that sex, education, race, AFQT scores, and months spent in Delayed Entry Program consistently affect attrition behavior while the relationship between age at entry and attrition is not clear. The decomposition technique used in the thesis finds that there are generally big differences between the predicted and the actual changes in attrition and that the direction of the predicted change and actual change is generally in opposite directions. The thesis recommends that the role of other factors, such as service-specific policies be researched to keep attrition from further rising and that the decomposition technique be replicated for other beginning and end points.

TABLE OF CONTENTS

x

ACKNOWLEDGMENT

I thank my wife, Ayse. If it had not been for her support, understanding, and affection this thesis could not have been completed. I also want to thank Prof. Stephan L Mehay and Prof. Mike Cook for their guidance during the work in performing this study.

I.   INTRODUCTION

In an era of limited resources it has become increasingly important for the Department of Defense to use its resources efficiently. As Cooke and Quester (1992) stated in their study of first-term attrition, selecting military recruits who are likely to be successful – who can complete the first-term of service – means that up-front training dollars will not be wasted. The purpose of this thesis is to analyze the determinants of military attrition. This thesis will estimate an attrition model for several entry cohorts for all services. These estimates will then be used in a decomposition technique to explain changes in attrition over time. The thesis will use the results of the statistical models to decompose changes in attrition into those due to changes in the demographic composition of enlisted cohorts versus those due to changes in the marginal effect of each demographic characteristic.

A.   BACKGROUND

A relationship found between a dependent variable and one or more independent variables in a multivariate model is statistical in nature but as Gujarati stated "this relationship per se does not logically imply causation. To ascribe causality one must appeal to a priori or theoretical considerations" (1995 p.20). This means that one must build a theoretical model that establishes the causal relationship between a dependent variable and a set of independent explanatory variables. By making use of statistically significant relationships between dependent and independent variables, one can manipulate the values of certain variables over which he or she has control in order to affect outcomes of interest.

1

Researchers have used multivariate regression models to investigate the relationships between various causal factors and first-term attrition. The results of these models have been used to formulate policies to reduce attrition. Cooke and Quester (1992) and Hosek et al. (1987) built several multivariate models to explain attrition behavior. They presented theoretical considerations to specify their estimating the model. The theoretical considerations were used to identify the causal relationships between attrition and the explanatory variables. Three of the variables that were found to have the strongest effect on first-term attrition were age at entry, having a high school diploma, and Armed Forces Qualification Test (AFQT) scores. In particular, having a high school diploma and higher AFQT scores – also called high quality recruits - were found to decrease attrition. Being older at entry into the military was associated with higher attrition. Over the years the U.S. military has experimented with using these three characteristics to screen potential applicants in an effort to decrease the attrition rate. But even though the average AFQT score of recruits has risen, average age at entry has decreased, and most importantly, the percentage of high school diploma graduates has increased, the expected decrease in attrition rate has not taken place.

However, an increase in high quality recruits may not explain the unexpected outcome by itself. Although the three characteristics mentioned above may have the greatest effect on attrition behavior in statistical models and the composition of entry cohorts with these characteristics may have increased overtime, analyses that do not account for the changes in the effects of these three characteristics – i.e., a change in the coefficients of these variables in a multivariate model - are incomplete. In addition,

analysis must also account for the changes in the composition of other variables in the model and the changes in their effects on attrition overtime.

B.   OBJECTIVE

The objective of this thesis is to analyze the determinants of first-term attrition and changes in those determinants over time by using statistical decomposition techniques. This study focuses on estimating cohort attrition rates by using the statistical estimates obtained from multivariate models applied to various entry cohorts.

C.   RESEARCH QUESTIONS

1.   Primary Research Question

To estimate models of first-term attrition using cohort data to determine the effects of various factors on attrition behavior.

2.   Secondary Research Questions

Why has attrition not dropped given the significant rise in recruit cohort quality? Do conventional cross-sectional studies yield misleading results in terms of what affects attrition?

D.   SCOPE AND LIMITATIONS

This thesis will develop an attrition model similar to the ones used in earlier studies. The model will be used to estimate the attrition behavior of individuals in

specific cohorts based on their characteristics at the time of enlistment. Thus, the model will not involve the performance levels of recruits during their first-term of service that may have an effect on attrition. However, since the accession of recruits to the military occurs only at the entry level, a multivariate model that establishes a relationship between attrition and a set of variables observed at the time of enlistment would be more useful for the U.S. military's screening policy. The models will be estimated using cross-sectional data for entry cohorts for 1984, 1989, and, 1994. A decomposition technique is then applied to the data to identify the source of differences in attrition rates in two different years. Based on the results, certain suggestions as to the source of the first-term attrition will be made. Cohort files that will be used in this thesis were provided by the Defense Manpower Data Center (DMDC), Monterey, CA.

E.   ORGANIZATION

The introduction chapter has addressed the focus of the thesis. Chapter II reviews literature to provide the theory for specifying an attrition model that is used in the analysis of data. Chapter III specifies the estimation model and discusses statistical decomposition techniques. In Chapter IV the model is estimated using a binary logit model and maximum likelihood techniques. The results of the decomposition technique are discussed in Chapter IV and Chapter V. Chapter VI contains summary, conclusions, and recommendations.

4

II. LITERATURE REVIEW

This chapter reviews the literature to gain the insight to be able to answer the primary and secondary research questions. In the first two studies reviewed below, statistical attrition models are estimated and the findings are discussed. The thesis uses these studies to help specify a statistical model that is used in the analysis of the data. The last two studies that are reviewed below attempt to address the question why the first-term attrition rate has not dropped over time given the increase in cohort quality. These two studies apply two different approaches and, thus, provide comparisons for the decomposition analysis used in this thesis.

A. JOHN ANTEL, JAMES R. HOSEK, CHRISTINE E. PETERSON, "MILITARY ENLISTMENT AND ATTRITION; AN ANALYSIS OF DECISION REVERSAL," THE RAND CORPORATION, SANTA MONICA, CALIFORNIA, JUNE 1987

Antel et al. explored the determinants of first-term attrition. They established attrition hypotheses by examining the issue from both the enlistee's perspective and the services' perspective. The authors hypothesized that "the enlistee would be less likely to leave the service the greater his ability to plan and the higher his net value of enlistment. Similarly, the service should be less likely to discharge the individual the more effective its enlistment screens and the higher the service's net value of having the individual as an enlistee." They stated that persons with greater ability to plan could evaluate their alternatives more accurately. Thus, they were less likely to be wrong in their assessments of the military's value to them and, consequently, less likely to leave the military before the term ends. Persons with a history of employment instability were thought to be poor

planners. Participation in the Delayed Entry Program (DEP) was also thought to indicate an individual's relatively clear occupation preferences and thus to relate to their ability to plan.

With respect to educational categories, they compared seniors with high school graduates. Evaluating the relative attrition rates of these two groups, their theory focused on two points: selectivity and planning ability. Concerning selectivity, they hypothesized that attrition would be higher for graduates than seniors because graduates have repeatedly rejected the military. As a foundation for their argument, they said that when the graduates were seniors they had the same civilian job opportunities but they chose not to enlist. Thus, the authors concluded that the graduates have a lower taste for military service. Concerning planning ability, they asserted that persons with more experience should plan more accurately. Their hypothesis was that graduates should be less likely to err in evaluating the job match and thus, would have lower attrition rates. These two effects work in opposite directions and the issue of which effect would dominate was left to empirical analysis. The study hypothesized that older recruits were more likely to leave the service than younger ones since, as the authors stated, older recruits tended to have lower cognitive abilities, as evidenced by lower AFQT scores. In another study (Buddin, 1984) it was also stated that older recruits may actually be "labor market lemons." With respect to race, the authors hypothesized that Blacks and Hispanics should have lower attrition rates than whites since they had superior opportunities in the military than in the civilian sector.

From the services' point of view, the attrition hypotheses were based on enlistment and occupation eligibility screens. AFQT scores were viewed as a general

measure of trainability. Higher AFQT scores were associated with a high likelihood of completing training programs. They hypothesized that recruits with higher AFQT scores would have lower attrition rates during basic training than individuals with lower scores. As for post-training attrition, the authors viewed AFQT scores as an indicator of general productivity. Thus, they hypothesized that persons with higher AFQT scores should be more adept at their tasks and consequently less likely to be discharged for inadequate performance. The authors hypothesized that people who expect educational benefits (e.g., college funding) would exert greater effort to master any skill and less likely to be discharged by the service. Civilian wage rates of individuals and their job tenures were also considered in the study. If the wage rates showed high productivity in the civilian sector, and if the service valued it in the same way, the authors hypothesized that attrition should decline with wage. They thought longer job tenure may also indicate productivity as well as the willingness to adapt to the employer; Thus, they hypothesized that attrition should decline with job tenure.

For the purposes of testing these hypotheses, they used the 1979 DOD Survey of Personnel Entering the Military Service. All individuals in the study were male. They analyzed the attrition behavior of seniors and graduates separately. Analysis of 6-month and 35-month attrition was made for both seniors and graduates. Since this thesis looks at 48 months attrition, 35-month attrition results are stressed in this review.

In their empirical results, age was statistically significant for only the 19-year-old group of seniors. For graduates there was no significant age effect. The authors used AFQT scores instead of mental categories and found that AFQT scores had a negative effect on attrition. Longer time spent in DEP was also found to reduce attrition.

7

Education expectations were negatively related to attrition, as hypothesized. Employment instability, as indicated by whether the recruit had been jobless at least once, was found to have a positive effect on attrition. With respect to race, attrition probabilities of Blacks and Hispanics were lower than whites but the differences were not statistically significant. Wage rates and job tenures were found to be unrelated to attrition. Graduates had lower attrition probabilities than seniors. Recruits who had GED credentials had a statistically insignificant higher attrition probability than graduates.

B. TIMOTHY W. COOKE, ALINE O. QUESTER, "WHAT CHARACTERIZES SUCCESSFUL ENLISTEES IN THE ALL-VOLUNTEER FORCE: A STUDY OF MALE RECRUITS IN THE U.S. NAVY," SOCIAL SCIENCE QUARTERLY, VOLUME 73, NUMBER 2, JUNE 1992

Cooke and Quester focused on identifying those characteristics of recruits that were related to their chance of being a "successful" first-term sailor. "Success" was defined as finishing their term of service, getting promoted to E-4 or above and reenlisting. The data used in the analysis were composed of male recruits who entered the Navy in fiscal years 1978 through 1982 and who had initial obligations of four years. They used similar variables as used in Antel et al. study. Their way of categorizing some variables was different from the Antel et al. study. For example, they interacted AFQT categories and educational indicators together. Thus, diploma graduates and AFQT Cat I-IIIA was a single binary variable. AFQT Cat IIIB-IV was also interacted with graduate and non-graduate status. They estimated the probability of completing the first-term of service and other success measures by using logit models.

Their results indicated that diploma graduates with high-test scores had the largest probability of completing first-term of service. Having a high school diploma had the greatest positive effect on completion. Months spent in DEP had a positive effect on completing the first-term (negative association with attrition). Blacks and Hispanics were more likely to complete the first-term than the non-black/non-Hispanic group. Higher AFQT categories were associated with lower probabilities of attrition, which was also found in Antel et al. study. Unlike the Antel et al. study, however, Cooke and Quester did not include the educational expectations and employment history of recruits in the analysis. Moreover, they did not include age separately in the model but combined it with high school graduate status. The category of diploma graduates who were 17-18 years old was found to have an insignificant effect on completing the first-term.

C.   RICHARD BUDDIN, "TRENDS IN ATTRITION OF HIGH-QUALITY MILITARY RECRUITS," THE RAND CORPORATION, SANTA MONICA, CALIFORNIA, AUGUST 1988

Buddin examined non-prior-service high-quality recruits since they were considered relatively homogenous by the services and the trends in attrition among them suggested that factors other than recruit characteristics, such as service policies and practices, were affecting attrition. Table 1 is reproduced from the Buddin study. Table 1 shows the percentage of male and female high school diploma graduates, the percentage of high quality recruits – those who have high school diploma and who score above the 50th percentile on the AFQT – and 6-month and 36-month attrition rates of cohorts from FY77 to FY86. Since this thesis is interested in first-term attrition of 48 months, 36-month attrition rates are stressed.

9

FY77 to FY86. Since this thesis is interested in first-term attrition of 48 months, 36-month attrition rates are stressed.

The author's argument was that if AFQT and high school diploma were good indicators of attrition, there should not have been a significant difference between attrition rates of different cohorts after adjusting for quality composition. For male

Table 1.
Trends in DOD accession quality
and cohort attrition, FY77 - FY86

Accession cohort	High School Diploma Grad (%)	High - Quality (%)	6-month Attrition Rate	36-month Attrition Rate
All Male Accessions				
FY77	69.0	27.0	13.9	30.7
FY78	73.2	30.7	11.5	27.4
FY79	69.0	27.7	10.9	28.9
FY80	65.1	27.6	10.7	31.1
FY81	79.5	37.6	10.6	28.7
FY82	84.7	42.7	11.7	27.6
FY83	89.9	49.1	11.6	25.1
FY84	92.0	50.7	10.9	23.9
FY85	90.9	53.2	9.9	na
FY86	90.3	54.4	11.0	na
Average	79.8	39.5	11.4	28.1
All Female Accessions				
FY77	90.6	45.2	12.8	37.2
FY78	90.3	48.1	12.9	36.3
FY79	90.6	39.5	13.2	35.1
FY80	86.6	32.8	14.3	37.5
FY81	92.7	44.6	14.9	36.1
FY82	97.2	58.2	15.4	34.7
FY83	99.6	66.5	15.8	33.8
FY84	99.5	65.7	15.7	33.3
FY85	98.1	66.8	13.5	na
FY86	97.9	71.8	14.2	na
Average	94.1	53.3	14.3	35.6

Source: Buddin (1988)

accessions, there was a negative correlation between the increase in cohort quality and 36-month attrition rates between FY80 and FY86. This negative correlation conforms to the expectations but the table also clearly showed that although the percentage of high quality male recruits increased from 31 percent to 43 percent between FY78 and FY82, three-year male attrition rates increased from 27.4 percent to 27.6 percent. The author used a multivariate logit model to control for other demographic characteristics that are thought to affect attrition – as mentioned in the previous two studies. The results showed that, after controlling for differences in the quality composition of each cohort, cohort attrition rates differed significantly from each other and the negative correlation found in the raw data disappeared. Moreover, the results showed even the opposite. The cohorts with a higher percentage of high quality recruits generally had higher attrition rates. For example, the attrition rate for FY83 was less than the attrition rate for FY82 in the raw data. But after using a multivariate logit model, it became clear that the attrition rate for FY83 was 0.5 percentage point greater than for FY82 after adjusting for quality composition.

He inferred from the pooled multivariate models that the three-year attrition rate was not solely a function of the quality composition of the accession cohort as measured in terms of educational attainment and AFQT score. The approach he used in the study involved examining attrition rates of high-quality recruits across training bases and examining attrition trends at individual bases after controlling for the composition of cohorts. The gist of his argument was that "if attrition rates were primarily determined by recruit quality, then comparable quality recruits should not have had different attrition rates at different bases or in different accession cohorts for the same base." If any

11

difference in attrition rates was to be found then the author would consider this as indirect evidence that differences in institutional policies and practices affected attrition levels. The Author's data encompassed all four services.

The author cited a study aimed at analyzing the Army's discharge policies and practices during basic training (BT) and advanced individual training (AIT) to identify possible causes for high attrition rates. This study was done by a group appointed by the Army's Training and Doctrine Command (TRADOC). As a result of their analysis, the group recommended that improvements should be made in leadership practices, in evaluation and counseling procedures conducted for a problem recruit and in physical conditioning of recruits to help reduce attrition rates. Endorsed by TRADOC, the recommendations of this study were implemented at the end of 1984. Buddin attributed the sharp reduction in 6-month attrition rates for FY84 and FY85 cohorts to the effect of the Army study and inferred that service policies as well as recruit quality have an important bearing on attrition rates. Buddin, in his statistical analysis, found that for BT, AIT, and post-training, the same training bases had different attrition rates over time and several training bases in the same cohort had different attrition rates.

Based on statistically significant differences in attrition rates among cohorts and training bases, the author concluded that cohort characteristics alone do not determine the attrition rates. He stated that different attrition policies and practices that are implemented in different training bases and in different cohorts might explain the difference in attrition rates of cohorts. The traditional indicators of attrition such as AFQT scores and months in DEP had negative signs in the regression results in parallel to the findings in the previous two studies reviewed above. Buddin used four dummies

12

for recruits whose ages are 17, 18, 19, 20, and above 20 at entry to distinguish age effects. Regression results did not show a specific pattern across age dummies as opposed to expected positive relationship between attrition and age. For example, for the Air Force FY82 cohort of men, 17-year-old recruits had a significantly higher probability of basic training attrition than 18-year-old males – the omitted category for age - and for the Army FY84 cohort of men, 17-year-old recruits had a significantly lower probability of basic training attrition than 18-year-old males. The effects of 19, 20, and older age groups changed from cohort to cohort. The effect of some college education on attrition was also analyzed in this study. Recruits who attended college one year, two years or three and four years and college graduates were grouped separately. The attrition rates of these groups were compared to the attrition rate of high school diploma graduates. For all cohorts and services recruits with some college had a lower attrition rate than high school diploma graduates and for most of the regressions, the coefficients were statistically significant. But there was no clear pattern in attrition rates among the college attendance variables. For some cohorts recruits who attended college for two years had a lower attrition probability than college graduates; for other cohorts, the opposite was true. The effect of race on attrition was also examined. The cohorts were grouped into blacks and non-blacks in terms of race. For most of the regression results blacks were less likely to leave prematurely from the service than non-blacks.

D. STEPHEN L. MEHAY, "ALTERNATIVE METHODS FOR ANALYZING FIRST-TERM ATTRITION IN THE U.S. MILITARY," U.S. NAVAL POST GRADUATE SCHOOL, MONTEREY, CALIFORNIA, JUNE 1999

The author examined a shift-share analysis implemented by Cooke, Grogan and Taggard (1990) to decompose changes in first-term attrition rates between fiscal 1984 and 1985-1988. The main purpose of the Cooke et al. study was to predict what attrition rates would have been in cohorts 1985-1988 based on changes in the proportion ("share") of recruits with certain attributes, 1984 cohort being the reference year. The difference between the predicted attrition rate and the observed attrition rate was named "unexpected" change in attrition, which was not associated with changes in recruit attributes. This unexpected change in attrition was thought to represent the "shift" in attrition behavior for each group of recruits.

As Mehay noted, the study by Cooke et al. found that first-term attrition rates for Navy entry cohorts after 1984 have been higher than those for fiscal 1984 and earlier cohorts. The shift-share analysis approach would enable the analyst to determine how much of an increase in attrition rate can be attributed to the change in the shares between FY1984 and FY 1985-1988 and to shifts in the attrition behavior of later cohorts. Mehay indicated that the Cooke et al. study used traditional recruit background characteristics to predict Navy first-term attrition: (1) educational credentials, represented by high school diploma grads, GED or equivalent certificates, and non-high-school graduates; (2) AFQT categories I-IV; (3) DEP participation; (4) waiver status; and (5) entry program (GENDET versus other). To predict attrition rates for the future cohorts, they computed

14

baseline attrition rates for each characteristic in fiscal 1984. Later by using these rates

and the shares in the future years, attrition rates were predicted for the later years.

Mehay explained the calculation used in the study as in the following equations.

Let the attrition rate for 1984 be r_{84} and r_{88} for 1988. Each cohort can be grouped into n

categories (recruit characteristics), with the number of recruits in each category

represented by $q_{84,i}....q_{88,i}$. Thus, each category has a baseline attrition rate $r_{84,i}........ r_{88,i}$.

Then,

$$r_{84} = \Sigma\, r_{84,i}\, q_{84,i}$$

$$r_{88} = \Sigma\, r_{88,i}\, q_{88,i}$$

The decomposition was expressed as:

$$r_{84} - r_{88} = \Sigma\, r_{84,i}\, q_{84,i} - \Sigma\, r_{88,i}\, q_{88,I}$$

$$= \Sigma\, r_{84,i}\, (q_{84,i} - q_{88,i}) + \Sigma\, q_{84,i}\, (r_{84,i} - r_{88,i}) - \Sigma\, (r_{84,i} - r_{88,i})\, (q_{84,i} - q_{88,i})$$

The first term on the right hand side is the change in the attrition rate that would

have been expected had the rate for each category remained constant (i.e.,$r_{84,i}$), but the

number in each category changes ($q_{84,i} - q_{88,i}$). The remaining terms are associated with

changing attrition rates for each category ($r_{84,i} - r_{88,i}$). The sum of these two terms was

interpreted as the unexpected change in attrition.

The results of the shift-share analysis indicated that actual attrition rates exceeded

the predicted attrition rates. As the author put it, in most cases, the predicted rate based

on changing recruit characteristics was only one-fourth of the actual increase. The

increases appeared to be due to changes in attrition behavior for each recruit category.

Mehay put forth two explanations for the results of the Cooke et al. study. First, he

concluded that recruit characteristics chosen for the analysis might not accurately predict

attrition rates. He noted that the approach used grouped data rather than individual data to predict attrition and applied group averages to all individuals in each category. He suggested that predictions could have been generated for each individual by using micro-level data and a multivariate estimating model. He also stated that there might be other factors omitted from consideration, such as age at entry. If there is a variable that is thought to affect a dependent variable it should be included in a multivariate statistical model, otherwise the estimates may be biased (Gujarati 1995 p.207). As a second possible explanation, he stated that recruit characteristics did not change much over the period of analysis.

III. DISCUSSION OF THE ATTRITION MODELS

AND THE DECOMPOSITION TECHNIQUE

A. SPECIFICATION OF THE ATTRITION MODEL

This thesis uses data obtained from DMDC's enlisted master files. The cohort files for Fiscal Years 1984, 1989, and 1994 for each service make up the data sets used for the estimation of the attrition models and the decomposition analysis. The files contain information about the characteristics of individuals at the time of enlistment. Individuals who had a term of service of four years are used in the analysis for all of the services except for the Army. In the Army, since term of service indicates occupational assignment, those obligors with enlistment terms of three and four years are combined and analyzed together. Only four-year obligors for other three services are used because this group represents the majority of the entry cohorts. Also, combining individuals with different contract lengths may give biased estimates since previous research shows that contract lengths affect attrition.[1] This study also excludes recruits with prior enlisted service. These are individuals who completed their first term in the service and left the service, then later returned. The specification of the attrition model is based on the following considerations:

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[1] North, James H., and Adeboyo M. Adedeji, "Rankings by Historical Attrition Rates of Potential Marine Corps Recruits," Center for Naval Analyses, Alexandria, VA, September 1991, p.2.

1. Dependent Variable

Attrition is defined to occur when the recruit leaves the military before completing the 48 month contractual obligation (except for the Army) and when the recruit has an Interservice Separation Code (ISC) between 10 and 17, or between 60 and 99, or 101 or 102. Also, ISCs between 30 and 42 are deleted from the sample since those reasons for leaving the service involve the death of the recruits or their transfer into Officer Programs and thus are not considered to be attrition. A full list of ISCs is presented in Appendix A. The definition of attrition takes into consideration the three-year obligors for the Army, and bases attrition for them on separation before 36 months of service. Attrition is coded as a binary variable for statistical estimation purposes. Attrition is coded as 1 if the recruit meets the criteria above and 0 if the recruit does not meet the criteria.

2. Explanatory Variables

a) <u>Age</u>: Since the findings from past research indicate no clear effect of age at entry on attrition, this study examines the attrition behaviors of several age groups. Seven age categories are based on recruits who are 17, 18, 19, 20, 21, 22, and 23-years-old and above. A dummy variable is created for each of the seven age groups. The base category in the attrition model is the 18-year-old group. There is no a priori hypothesis about the effect of entry age on attrition, although some prior studies have found a positive relationship between entry age and attrition.

b) <u>Gender</u>: Cohorts include both males and females. The base case in the attrition models is males. The a priori hypothesis is that females are more likely to leave the military before the end of their contract than males after controlling for other characteristics.

c) <u>Education</u>: Educational categories are represented by three groups; (1) High school diploma graduates (HSDG) who are individuals with their high school diplomas after regular attendance; (2) Individuals who have additional years of education after high school (HIGHEDUC), including college dropouts, college graduates, and people who have master's and doctorate degrees; and (3) Individuals who have a G.E.D. or alternative credential or are non-high school graduates (NHGEDCRE). Although it would be better to analyze separately the attrition behavior of all three of these groups, the small cell size for these groups in FY94 for each service does not allow a separate estimation. The similarities of these groups in terms of their attrition behavior, as illustrated from past research, provides some justification for grouping them together. One a priori hypothesis is that G.E.D holders/non-high school graduates are more likely to attrite than high school diploma graduates, and high school diploma graduates are more likely to attrite than those with some college or college degree (HIGHEDUC). The preliminary analysis of data indicated that about 10 percent of entry cohorts were in the higher education category (HIGHEDUC) in FY84, but only about two percent in fiscal years 1989 and 1994, the largest drop being in the Air Force (from 16.5 to 2.1). This decrease in the percentage of HIGHEDUC appeared to represent an error in the data, and DMDC representatives confirmed that coding of the education variables had changed in

1987[2]. The change made it difficult to identify personnel with "some college." Consequently, individuals with higher education (some college) were deleted from the sample. The result of multivariate regression models and decomposition analyses estimated without personnel with some college (HIGHEDUC) in the sample will be presented in Chapter IV. The results of the regression models and the decomposition analyses for the sample with HIGHEDUC included is presented in Appendix D. HSDG is the base case in the attrition analyses for both samples.

d) <u>AFQT scores</u>: AFQT scores are used as a continuous variable instead of using dummies for AFQT categories, as was done in most previous studies. Thus, the risk of losing information by using AFQT mental categories is prevented. The a priori hypothesis is that there is a negative relationship between AFQT scores and attrition.

e) <u>Months in DEP</u>: This variable shows the months spent in DEP. It is used as a continuous variable. It is hypothesized that the longer the time spent in DEP the lower the probability of active duty attrition, as supported by the first three studies reviewed in Chapter II.

f) <u>RACE</u>: Four dummy variables are created to identify the effect of race or ethnicity on attrition, namely whites, Blacks, Hispanics, and "other" minorities. "Other" minorities include American Indians, Alaskan Natives, and Asian Americans. Whites are the base case in the attrition models. The a priori hypothesis is that minority groups have lower attrition probabilities than whites since minorities have better job prospects in the military than in the civilian economy.

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[2] DMDC creates the entry cohorts from files provided by the Military Entrance Processing Command (MEPCOM). MEPCOM's definition of education apparently changed in 1987.

Since the dependent variable can either take on a value of zero or one, a binary logit model is used instead of an ordinary least squares regression. Coefficients of variables in the model are estimated by using maximum likelihood estimation techniques. SAS 6.09 software package is used for statistical analysis of the data. The logistic distribution is defined as follows:

$$Pr\,(Y = 1) = \frac{1}{1 + e^{-(\beta_o + \beta_i X_i)}}$$

where Y is the probability of the outcome variable (attrition), βs are the parameters to be estimated and Xs are the explanatory variables. As can be seen from the equation, the relationship between explanatory variables and attrition is not linear. Thus, the coefficients estimated from the maximum likelihood estimation technique indicate the effect of explanatory variables on the natural logarithm of the odds of ratio of attrition rather than a direct effect.

B.   DISCUSSION OF DECOMPOSITION TECHNIQUE

The parameters of the explanatory variables obtained from the maximum likelihood estimates predict the log odds of the outcome variable, attrition. The parameters are produced by the statistical package as to provide closest possible estimation for the observed outcome. Given these parameters and their signs one can predict the change in attrition if certain changes occur in the composition of the sample, that is, in the characteristics represented by the explanatory (X) variables.

21

As stated above, the nonlinear relationship between the dependent variable and the independent variables does not allow prediction of future values of dependent variable if the composition of explanatory variables changes. Mathematically, the separate effect of an explanatory variable on the dependent variable is given by the partial derivative of the logit formula illustrated above, which can be obtained from the following (Gujarati 1995):

$$\beta_i \ (P) \ (1-P)$$

where β = the estimated coefficient for variable X, and P = the proportion of the sample choosing the outcome (separation).

As the formula suggests, the effect of the explanatory variable depends on the specific probability value, P, that one chooses. One can assign a base case person arbitrarily and calculate the probability of this person attriting. In order to find the independent effect of a variable, one can change the value of each characteristic one at a time while holding other characteristics constant. The difference between the probability calculated by increasing each characteristic by a certain amount (traditionally from 0 to 1 for discrete variables and from the mean to 1 plus the mean for continuous variables) one at a time and the base case probability gives the "marginal effect" (B) of the relevant variable. One can accept marginal effects as the direct effect of the explanatory variables. By using marginal effects one can predict the values of the dependent variable if certain changes occur in the explanatory variables (X's). This thesis uses marginal effects to identify the effects of explanatory variables on attrition and these marginal effects are then used in the decomposition technique.

The decomposition analysis can be summarized as follows: After a multivariate (logit) statistical model has been estimated one can predict the future values of the dependent variable by making use of the marginal effects for each explanatory variable. This approach clearly differs from what Cooke, Grogan and Taggard did as reviewed by Mehay (1999) and reviewed in Chapter II. In that study the authors used raw data to predict future attrition rates. The disadvantage of using raw attrition rates of different groups (X's) is that the effect of other variables on attrition is not controlled for. Using a multivariate approach allows the analyst to obtain the separate effect of each explanatory variable after controlling for other variables. Thus, if high school graduates (HSDG) are less likely to attrite than NHGEDCRE in the model, then decreasing the percentage of NHGEDCRE is expected to decrease the attrition rate by a certain amount. This amount can be calculated by the marginal effect of NHGEDCRE times the change in the proportion of the sample who are non-graduates/GED holders (NHGEDCRE) between the two periods during which the change took place.

The first part of the decomposition analysis involves the calculation of the effects of changes in cohort quality on attrition for each of two cohorts, which will also be referred to as "change in X's." That is, the calculation procedure described above involves doing it for all variables in the model concurrently. This approach will give a clearer analysis than was done in the Cooke et al. study. For example, an increasing percentage of HSDGs in the entry cohorts can be expected to decrease overall cohort attrition as calculated by the marginal effect of this group times the percentage increase (assuming that HSDGs reduce attrition). But if the increase in HSDG is maintained by recruiting mostly women and whites, traditionally high risk groups compared to men and

23

other races, then the increase in the percentage of women or whites may reduce the effect of the HSDG increase. Thus, the first part of the decomposition analysis, a change in X's, gives the effect of the change in the demographic characteristics between two cohorts. The net effect of all these effects on the attrition rate due to the change in cohort quality is obtained by adding the separate effects for each characteristic (X). The effect of the change in X's are weighted by the coefficient from the earlier cohort, as can be seen in the following formula:

$$B_{it1} * (X_{it2} - X_{it1})$$

B = Marginal effect of the ith variable in the earlier cohort, t_1

X = Median value of the variable if the variable is discrete (e.g., female, black...);

Mean value of the variable if the variable is continuous (e.g., AFQT...)

t = Time; t_1 represents the earlier cohort and t_2 represents the latter cohort.

The expected change in attrition due to the change in all cohort characteristics is given by the summation over i of parameters in the above formula:

$$\sum_i B_{it1} * (X_{it2} - X_{it1})$$

As it is clear from the above calculations only X's are allowed to change while the β coefficient is assumed to remain constant.

The second part of the decomposition analysis involves identifying the effect of a "change in B's" on the attrition rates. Even though the percentage or mean value of a cohort characteristic (X) in the later cohort remains the same as in an earlier cohort, the statistical relationship between that characteristic and attrition may change. A change in

24

this relationship is given by the difference in the β coefficients estimated for each of two

cohorts ($B_{it2} - B_{it1}$). This difference is then weighted by the X's:

$$(B_{it2} - B_{it1})* \ (X_{it1}+X_{it2}/2)$$

B_{it2} = The marginal effect of the ith variable in the latter cohort

B_{it1} = The marginal effect of the ith variable in the previous cohort

The other symbols represent the same concepts as they do in the earlier formula

for the change in Xs. As the formula suggests, while B's change, X's are held constant.

Instead of using an X value of either one of the separate cohorts, the average of the two

cohorts is used. The net effect of changes in B's of all variables on attrition rate is then

based on summing all of the differences over i of parameters:

$$\sum_{i} (B_{it2} - B_{it1}) * (X_{it1}+X_{it2}/2)$$

The base case person that is used to calculate the marginal effects (B's) is defined

as a white male, 18 years old, with a high school diploma and the average AFQT score of

his cohort, who has spent some time in DEP, the exact length of which is equal to the

average of his cohort.

The results of the multivariate models and the decomposition technique applied to

the samples without HIGHEDUC is given in the text in Chapter IV and Chapter V. The

results of the analysis of the samples with HIGHEDUC included are given in Appendix

D.

IV. RESULTS OF THE MODELS AND

DECOMPOSITION TECHNIQUE

This chapter presents the results of the models and the decomposition technique for all four services, and entry cohorts 1984, 1989, 1994. Decomposition results are presented by considering the change in each independent variable (the X's) and the change in marginal effect of each independent variable (the B's).

Figure 1 graphs the attrition rates of services for fiscal years 1984, 1989, and 1994. There was an upward trend for all four services during this period, except for the Marine Corps, whose attrition is fairly flat. Table 2 shows the actual attrition rates for each service and entry cohort.

A. RESULTS OF THE CROSS SECTIONAL MODELS

As discussed in Chapter III the multivariate model that is used to estimate the coefficients of the explanatory variables is as follows:

$$P \text{ (Attrition} = 1) = f \ (\beta_0 + \beta_1 * \text{Female} + \beta_2 * \text{ Black} + \beta_3 * \text{Hisp} + \beta_4 * \text{Other} +$$

$$\beta_5 * \text{Nhgedcre} + \beta_6 * \text{Age17} + \beta_7 * \text{Age19} + \beta_8 * \text{Age20} + \beta_9 * \text{Age21} + \beta_{10} * \text{Age22} +$$

$$\beta_{11} * \text{Age23PLS} + \beta_{12} * \text{AFQTPRCT} + \beta_{13} * \text{Depmos)}$$

Tables 3 and 4 show the estimated coefficients from the attrition model and the marginal effects (B's) for entry cohorts 1989 for all four services. The coefficients and marginal effects for entry cohorts 1984 and 1994 for all services are presented in Appendix B. The results of the models indicate that females are more likely to attrite than males and the coefficients of this variable are significant at the 0.05 level for all

Figure 1. Attrition rates by services and by entry cohorts

Table 2.
Attrition rates (in percent) by year, by service

	FY84	FY89	FY94	percentage point change in attrition between FY84 & FY94
Army	31.7	34.9	37.5	5.8
Navy	26.7	34.5	37.2	10.5
Air Force	25.5	29.7	32.1	6.6
Marine Corps	31.0	32.1	32.9	1.9

services and years. Blacks are less likely to leave the military than whites. In 11 out of 12 regression models the coefficients of Black have the expected signs (negative) and are significant (In the Marine Corps 1989 sample the Black coefficient has a positive sign but it is insignificant at the 0.10 levels. Hispanics and other minority groups are less likely to leave active duty than whites. Non-high school graduates/G.E.D. holders are more likely to attrite than high school graduates and the coefficients are significant. AFQT scores and months spent in Delayed Entry Program have a negative relationship with attrition, as hypothesized. The relationship between age at entry and attrition is not consistent among services and models. In some cases older recruits have lower attrition probabilities, in other cases higher attrition probabilities than 18-year-old group recruits. Also, some of the age categories are not significant. These results regarding age are in parallel to the findings in Buddin's (1988) study. The only group that has a consistent relationship with attrition is the 17-year-old group. 17-year-olds are more likely to attrite than 18-year-olds in 11 out of 12 regression models and five of them are not significant at $\alpha = 0.05$ level. However, this finding is in contrast to that of some of the earlier studies which found a positive relationship between attrition and age.

Table 3.
Coefficients and Marginal effects of
variables for Army 1989 and Navy 1989 cohorts
Standard errors in paranthesis

Variables	Army 1989		Navy 1989	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Intercept	-0.2364* (0.0311)	———	-0.1092* (0.0328)	———
Female	0.6433* (0.0212)	0.1544	0.3847* (0.0236)	0.0877
Black	-0.4459* (0.0188)	-0.0910	-0.1778* (0.0216)	-0.0367
Hispanics	-0.5746* (0.0349)	-0.1139	-0.2493* (0.0308)	-0.0507
Other min.	-0.4041* (0.0453)	-0.0832	-0.7785* (0.0534)	-0.1392
NHGEDCRE	0.8065* (0.0223)	0.1951	0.8760* (0.0235)	0.2091
Age 17	0.0971* (0.0317)	0.0219	0.1716* (0.0338)	0.0379
Age 19	0.0123 (0.0205)	0.0028	0.0586* (0.0216)	0.0127
Age 20	0.0121 (0.0253)	0.0027	0.0243 (0.0277)	0.0052
Age 21	0.0332 (0.0313)	0.0074	0.0314 (0.0348)	0.0068
Age 22	0.0586 (0.0372)	0.0132	0.0780 (0.0421)	0.0170
Age 23+	0.0079 (0.0275)	0.0018	0.1489* (0.0294)	0.0327
AFQTPRCT	-0.0066* (0.0004)	-0.0015	-0.0079* (0.0004)	-0.0017
Depmos	-0.0268* (0.0026)	-0.0059	-0.0568* (0.0024)	-0.0120
-2 Log L	103060		88086	
Sample size	82,175		70,640	

*   significant at 0.01 significance level
**   significant at 0.05 significance level
***   significant at 0.10 significance level

Table 4.
Coefficients and Marginal effects of
variables for Air Force 1989 and Marine Corps 1989 cohorts
Standard errors in paranthesis

Variables	Air Force 1989		Marine Corps 1989	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Intercept	-0.3157* (0.0566)	———	-0.3524* (0.0619)	———
Female	0.5307* (0.0261)	0.1201	0.8280* (0.0535)	0.1929
Black	-0.3758* (0.0356)	-0.0712	0.0295 (0.0366)	0.0061
Hispanics	-0.4308* (0.0664)	-0.0805	-0.4782* (0.0564)	-0.0877
Other min.	-0.4347* (0.0753)	-0.0811	-0.2760* (0.0784)	-0.0532
NHGEDCRE	0.6968* (0.1011)	0.1608	0.6736* (0.0510)	0.1545
Age 17	0.0303 (0.0680)	0.0063	0.0716 (0.0610)	0.0149
Age 19	0.0274 (0.0286)	0.0056	0.0893* (0.0347)	0.0186
Age 20	-0.0716** (0.0360)	-0.0145	0.1065** (0.0500)	0.0223
Age 21	-0.1036** (0.0433)	-0.0209	0.1834* (0.0680)	0.0390
Age 22	-0.1847* (0.0551)	-0.0366	0.1777** (0.0904)	0.0378
Age 23+	-0.2319* (0.0432)	-0.0455	0.4922* (0.0723)	0.1103
AFQTPRCT	-0.0061* (0.0007)	-0.0012	-0.0060* (0.0008)	-0.0012
Depmos	-0.0281* (0.0028)	-0.0057	-0.0364* (0.0037)	-0.0074
-2 Log L Sample size	47277 39,524		29670 24,234	

*   significant at 0.01 significance level
**   significant at 0.05 significance level
***   significant at 0.10 significance level

As discussed in Chapter II the coefficients estimated from a binary logit model do not give the "direct" effect of the explanatory variables on the outcome variable because of the non-linear relationship between the outcome variable and the explanatory variables. In order to be able to measure the "direct" effect of the variable one must calculate marginal effects. For example, in the Army cohort for 1989, the marginal effect of being a female is 15.44 percentage points. This means that females are 15.44 percentage points more likely to attrite than men in the 1989 Army cohort. Another interpretation is that an additional percentage point increase in the proportion of females in the sample would cause the attrition rate in that sample to increase by the change in the proportion of females times the marginal effect of being a female, in this case 0.1544. In the same sample Blacks, Hispanics, and other minorities are less likely to attrite than whites by 9.1, 11.3, and 8.3 percentage points, respectively. When these three ethnic groups are compared in terms of attrition probabilities Hispanics are the least likely to attrite and Blacks are less likely to attrite than other minorities (American Indians, Alaskan Natives, and Asian Americans) as understood by the magnitude of their marginal effects.

High school dropouts and G.E.D. holders are 19.5 percentage points more likely to attrite than high school diploma graduates. This means that a 10 percentage point decrease in the proportion of this group would decrease the attrition rate of the sample by 0.10 times 0.195, which is about 2 percentage points. The signs of the coefficients and the marginal effects of age categories are positive, which indicates that all of these age groups are more likely to attrite than the base category of 18-year-old group. However, as described above some previous studies have found a positive relationship between age

32

at entry and attrition, which renders the positive sign of the coefficient of 17 year-old group suspicious. Also, except for the Age 17 variable, the other age variables are not significant in the same sample. But the interpretations of the marginal effects are the same as the above. The marginal effect of AFQT scores is –0.0015. This means that as AFQT scores rise the probability of attrition decreases by the marginal effect of 0.0015 percentage points multiplied by the change in AFQT scores. The marginal effect of months spent in DEP is –0.0059. This indicates that an increase in the average months spent in DEP would decrease the attrition rate of this sample by 0.0059 times the change in the average DEP months.

B.   RESULTS OF THE DECOMPOSITION TECHNIQUE

1.   Change in Attrition Due to Changes in X's

This section discusses the effects of changes in the explanatory variables on attrition that took place between any two given cohorts. The change in an explanatory variable is expected to affect attrition by the change in its mean (if the variable is continuous) or median (if the variable is discrete) times the marginal effect of the variable in the previous cohort. Results are presented with respect to each variable.

Females:

As Table 5 shows there was an increasing trend in the percentage of females in the entry cohorts between 1984 and 1994 for all services. Table 6 gives the impact of these changes on attrition. Due to the positive relationship between attrition and being a female, an increase in the percentage of females is estimated to cause an increase in

33

attrition rates. For example, in the Air Force, the percentage of females increases 9.7

percentage points between year 1994 and 1984, a 69 percent increase. The marginal

effect of being a female in 1984 Air Force cohort is 0.08 (see Table B.3). The estimated

change in attrition would be the marginal effect of females times the change in the

Table 5.
Percentage of females by service, by entry cohort
and the changes in the percentage of females between cohorts

	Percent			Percentage point change		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	12.50	14.10	17.80	1.6	5.3	3.7
Navy	10.70	13.30	16.80	2.6	6.1	3.5
Air Force	14.00	21.10	23.70	7.1	9.7	2.6
Marine Corps	4.90	6.50	5.50	1.6	0.6	-1.0

Table 6.
Changes in the percentage of females and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	1.6	0.0023	5.3	0.0076	3.7	0.0057
Navy	2.6	0.0018	6.1	0.0043	3.5	0.0030
Air Force	7.1	0.0057	9.7	0.0077	2.6	0.0031
Marine Corps	1.6	0.0024	0.6	0.0009	-1.0	-0.0020

Source: See Appendix C and Chapter V

proportion of females. Thus, the increase in the proportion of females between 1984 and

1994 predicts that the attrition rate in FY94 will be 0.7 percentage points (0.0077 in

Table 6) higher than in FY84. Thus, if all other demographics and marginal effects

remained constant, but only the proportion of females increased by 9.7 percentage points between these years, it is estimated that the FY94 attrition rate would be the attrition rate in FY84 plus the estimated increase in attrition (0.7 percentage points) due solely to the increase in the proportion of the females. The USAF attrition rate in FY84 is 25.5%. Thus, the predicted attrition rate in FY94 due solely to the 9.7 percentage point increase in the proportion of females between FY84 and FY94 is 26.2 %.

Blacks:

Tables 7 and 8 give the percentage of blacks in the three entry cohorts by military service and the effects of these changes on attrition rates in each service. The increase in the proportion of Blacks of 5.9 percentage points in the Navy between FY89 and FY84 is

Table 7.
Percentage of Blacks by service, by entry cohort
and the changes in the percentage of Blacks between cohorts

	Percent			Percentage point change		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	23.90	27.80	23.40	3.9	-0.5	-4.4
Navy	14.30	20.20	15.80	5.9	1.5	-4.4
Air Force	13.10	12.60	14.30	-0.5	1.2	1.7
Marine Corps	17.20	19.40	13.10	2.2	-4.1	-6.3

estimated to reduce attrition by 0.1 percentage points while the increase of 3.9 percentage points in the Army between the same years is estimated to reduce attrition by 0.3 percentage points. Although the change in the proportion of Blacks in the Navy is greater than the change in the proportion of Blacks in the Army between these years, the predicted effect of a growing proportion of Blacks in the Army on attrition is greater than

the predicted effect in the Navy. This difference arises because the marginal effect in FY84 in the Army (-0.0887) is about three times the size of the marginal effect in FY84 in the Navy (-0.0297). Put differently, Blacks in the Army in FY84 are far less likely to attrite than their counterparts in the Navy in FY84.

Table 8.
Changes in the percentage of Blacks and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	3.9	-0.0034	-0.5	0.0004	-4.4	0.0040
Navy	5.9	-0.0017	1.5	-0.0004	-4.4	0.0016
Air Force	-0.5	0.0001	1.2	-0.0003	1.7	-0.0012
Marine Corps	2.2	-0.0006	-4.1	-0.0006	-6.3	-0.0003

Source: See Appendix C and Chapter V

Hispanics:

Table 9 shows the percent Hispanics and the changes in percent Hispanics between cohorts for all services. A 7.5 percentage point change in percent Hispanics between 1984 and 1994 in the Marine Corps is predicted to reduce attrition in FY84 by 0.6 percentage points as shown in Table 10.

Table 9.
Percentage of Hispanics by service, by entry cohort
and the changes in the percentage of Hispanics between cohorts

	Percent			Percentage point change		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	3.40	5.80	7.40	2.4	4.0	1.6
Navy	5.40	7.90	7.30	2.5	1.9	-0.6
Air Force	2.20	3.40	4.90	1.2	2.7	1.5
Marine Corps	3.70	8.10	11.20	4.4	7.5	3.1

Table 10.
Changes in percentage of Hispanics and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	2.4	-0.0020	4.0	-0.0030	1.6	-0.0020
Navy	2.5	-0.0006	1.9	-0.0004	-0.6	0.0003
Air Force	1.2	-0.0009	2.7	-0.0020	1.5	-0.0010
Marine Corps	4.4	-0.0003	7.5	-0.0060	3.1	-0.0020

Source: See Appendix C and Chapter V

Other minorities:

Percentages of other minorities (American Indians, Alaskan Natives, and Asian Americans) do not change much over time and across services. As Table 12 shows the effect of these changes are almost zero.

Table 11.
Percentage of other minorities by service, by entry cohort
and the changes in the percentage of other minorities between cohorts

	Percent			Percentage point change		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	3.0	3.1	3.6	0.1	0.6	0.5
Navy	2.4	3.1	3.9	0.7	1.5	0.8
Air Force	2.4	2.6	4.0	0.2	1.6	1.4
Marine Corps	3.6	3.6	3.5	0.0	0.1	0.1

Table 12.
Changes in percentage of Other minorities and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	0.1	0.0000	0.6	-0.0004	0.5	-0.0004
Navy	0.7	-0.0004	1.5	-0.0010	0.8	-0.0010
Air Force	0.2	-0.0001	1.6	-0.0010	1.4	-0.0010
Marine Corps	0.0	0.0000	0.1	0.0000	0.1	0.0000

Source: See Appendix C and Chapter V

NHGEDCRE (G.E.D. holders/Non-high school graduates):

The percentage of NHGEDCRE is the smallest in FY94 entry cohorts especially in the Army and Navy. This decrease seems to be a result of policies implemented to recruit more high school graduates.

Table 13.
Percentage of NHGEDCRE by service, by entry cohort
and the changes in the percentage of NHGEDCRE between cohorts

	Percent			Percentage point change		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	11.2	13.2	8.1	2.0	-3.1	-5.1
Navy	7.7	13.3	6.3	5.5	-1.4	-7.0
Air Force	1.4	1.0	1.4	-0.4	0.0	0.4
Marine Corps	5.2	7.2	5.0	2.0	-0.2	-2.2

Table 14 gives the estimated effects of changes in percentages of GED holders/Non-high school graduates on attrition. The 7-percentage point decrease between 1994 and 1989 in the Navy is estimated to reduce attrition in 1989 by about 1.5 percentage points. An interesting result is that even if the Navy's 1994 entry cohort were composed solely of high school diploma graduates (a 13.3 percentage point decrease from cohort 1989) the estimated decrease in attrition rate would be 2.75 percentage points.

Table 14.
Changes in percentage of NHGEDCRE and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	2.0	0.0049	-3.1	-0.0069	-5.1	-0.0103
Navy	5.5	0.0121	-1.4	-0.0030	-7.0	-0.0144
Air Force	-0.4	-0.0007	0.0	0.0000	0.4	0.0006
Marine Corps	2.0	0.0040	-0.2	-0.0004	-2.2	-0.0030

Source: See Appendix C and Chapter V

AFQT scores:

As Table 15 shows the average AFQT test scores have increased over time for all

services. Due to the negative relationship between AFQT scores and the attrition one

could expect a decrease in attrition rate as AFQT scores rise or an increase in attrition

rate as AFQT scores decline.

Table 15.
Average AFQT scores by service, by entry cohort
and the changes in the average AFQT scores between cohorts

	Average scores			Change in average scores		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	51.80	54.00	57.65	2.20	5.85	3.65
Navy	57.61	57.13	64.40	-0.48	6.79	7.27
Air Force	60.95	65.90	65.00	4.95	4.05	-0.90
Marine Corps	53.87	55.56	57.42	1.69	3.55	1.86

Table 16 presents the changes and the estimated effects of these changes on

attrition for the three cohorts. As the table indicates the largest change occurs in the Navy

40

between FY94 and FY89. The 7.27 increase in average AFQT scores between these years is estimated to reduce attrition by 1.2 percentage points. Recruiting higher ability individuals into the military is costly, and the return in terms of lower attrition rates seems to be small.

Table 16.
Change in average AFQT scores and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	2.20	-0.0025	5.85	-0.0066	3.65	-0.0050
Navy	-0.48	0.0008	6.79	-0.0110	7.27	-0.0120
Air Force	4.95	-0.0070	4.05	-0.0060	-0.90	0.0010
Marine Corps	1.69	-0.0030	3.55	-0.0060	1.86	-0.0020

Source: See Appendix C and Chapter V

Months in DEP:

Tables 17 and 18 show the average months spent in DEP and the effects of the changes in the average months spent in DEP on attrition.

Table 17.
Average months spent in DEP by service, by entry cohort
and the changes in average months in DEP between cohorts

	Average months in DEP			Change in average months		
	FY84	FY89	FY94	FY 84-89	FY 84-94	FY 89-94
Army	3.70	3.41	3.41	-0.29	-0.29	0.00
Navy	5.61	4.14	5.26	-1.47	-0.35	1.12
Air Force	4.96	5.90	4.80	0.94	-0.16	-1.10
Marine Corps	5.45	5.88	5.30	0.43	-0.15	-0.58

The services do not seem to have used DEP time as an explicit policy tool to reduce attrition rate even though the models show that longer time in DEP would decrease attrition rates. For the Navy, between FY89 and FY84 one and a half-month decrease in DEP is estimated to increase the attrition rate by 1.3 percentage points, which is the largest in Table 18.

Table 18.
Changes in average months spent in DEP and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.29	0.002	-0.29	0.002	0.00	0.000
Navy	-1.47	0.013	-0.35	0.003	1.12	-0.013
Air Force	0.94	-0.008	-0.16	0.001	-1.10	0.006
Marine Corps	0.43	0.004	-0.15	0.001	-0.58	0.004

Source: See Appendix C and Chapter V

Age at entry:

As Table 19 shows the average age at entry increases slightly over time for all services. Table 20 shows the estimated effects of the changes in the median values of age categories between cohorts on attrition for all four services. However, as discussed earlier there is no consistency in either the sign of some age categories or in the significance of the coefficients. Thus Table 19 bears only descriptive importance.

Table 19.
Age at entry by service, by entry cohort

	FY84	FY89	FY94	Difference in average age between FY84 & FY94
Army	19.36	19.59	19.89	0.53
Navy	19.55	19.51	19.54	-0.01
Air Force	19.35	19.49	19.50	0.15
Marine Corps	18.80	18.88	19.10	0.30

Table 20.
Estimated effect of change in
the percentages of age categories on attrition

	FY 84-89 effect	FY 84-94 effect	FY 89-94 effect
Army	0.0010	0.0020	0.0001
Navy	0.0001	-0.0004	-0.0010
Air Force	-0.0010	-0.0014	-0.0001
Marine Corps	0.0000	0.0011	0.0026

Source: See Appendix C and Chapter V

2. Change in Attrition Due to Changes in B's

A change in the marginal effect of a variable is estimated to change the attrition observed in a given cohort. The change in attrition between two cohorts is estimated to be equal to the change in the marginal effect times the average of the mean (if the variable is continuous) or median (if the variable is discrete) of the X variable in the two cohorts. Results are presented with respect to each variable.

<u>Females:</u>

Table 21 shows the marginal effects of gender for all services. All of the
marginal effects have positive signs, which indicate that females are more likely to attrite
than men for all services and for all fiscal years. However, marginal effects in FY89 are
greater than those in FY84, which shows that females became more quit-prone in FY89
than they were in FY84. Yet, in the 1994 cohort the situation reverses and females
become much less likely to attrite than they were in either the 1989 or the 1984 cohorts.

Table 21.
Marginal effects of Females by service, by entry cohort

	FY84	FY89	FY94
Army	0.1443	0.1543	0.1373
Navy	0.0715	0.0876	0.0280
Air Force	0.0803	0.1201	0.0712
Marine Corps	0.1532	0.1929	0.1112

Source: See Appendix C and Chapter V

The effects of these changes are shown in Table 22. In the Air Force between
1994 and 1989 a 4.9-percentage point change in marginal effect is estimated to decrease
attrition in 1989 by 1 percentage point. That is, if between these two years the
composition of the Air Force entry cohorts remained the same and only the marginal
effect of the females changed by 4.9 percentage points, the attrition rate in FY94 would
be 1 percentage point greater than it was in FY89.

Table 22.
Changes in Marginal effects of Females and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	0.0100	0.0013	-0.0070	-0.0010	-0.0170	-0.0027
Navy	0.0161	0.0019	-0.0435	-0.0059	-0.0596	-0.0089
Air Force	0.0398	0.0069	-0.0091	-0.0017	-0.0489	-0.0109
Marine Corps	0.0397	0.0022	-0.0420	-0.0021	-0.0817	-0.0048

Source: See Appendix C and Chapter V

Blacks:

As table 23 shows Blacks are less likely to attrite than whites, except in 1989

Marine Corps cohort (In 1989 USMC cohort the positive marginal effect is insignificant

at 0.05 level). Blacks are less likely to attrite - lower attrition risk - in FY89 than they are

in FY84 and become more likely to attrite in FY94 than in FY89. While Blacks in the

Navy, Air Force, and Marine Corps have similar attrition probabilities – as reflected by

the marginal effects – Blacks in the Army are more likely to stay in the service than their

counterparts in the other three services.

Table 23.
Marginal effects of Blacks by service, by entry cohort

	FY84	FY89	FY94
Army	-0.0887	-0.0910	-0.0851
Navy	-0.0297	-0.0367	-0.0194
Air Force	-0.0257	-0.0712	-0.0265
Marine Corps	-0.0287	0.0061	-0.0202

Source: See Appendix C and Chapter V

Table 24 shows the effects of changes in marginal effects on attrition. The effects range from 0.01 percentage point (Army 1989-1984) to 0.63 percentage point (Marine Corps 1989-1984). For example, in the Army, a change in the marginal effect of Blacks of 0.0059 between FY94 and FY89 increased the attrition rate in FY89 by 0.15 percentage points. Overall, there is very little change in marginal effects of Blacks.

Table 24.
Changes in Marginal effects of Blacks and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.0023	-0.0005	0.0036	0.0008	0.0059	0.0015
Navy	-0.0070	-0.0012	0.0103	0.0015	0.0173	0.0031
Air Force	-0.0455	-0.0058	-0.0008	-0.0001	0.0447	0.0060
Marine Corps	0.0348	0.0063	0.0085	0.0013	-0.0263	-0.0042

Source: See Appendix C and Chapter V

Hispanics:

For Hispanics the absolute magnitude of the marginal effects increases over time, which indicates that Hispanics become increasingly less likely to attrite than whites. As is the case with Blacks, Hispanics in the Army are the least likely group to attrite.

Table 25.
Marginal effects of Hispanics by service, by entry cohort

	FY84	FY89	FY94
Army	-0.0971	-0.1139	-0.1396
Navy	-0.0244	-0.0507	-0.0912
Air Force	-0.0824	-0.0805	-0.1011
Marine Corps	-0.0870	-0.0877	-0.1130

Source: See Appendix C and Chapter V

The fact that Hispanics become less likely to attrite over time is estimated to reduce cohort attrition rates. Although the change in percent Hispanic in the Army between FY94 and FY89 is about the same as in the Marine Corps, the estimated effects of these changes on attrition is different for the two services. This is due to the formula used for calculating the effects that use the weights of the frequencies of characteristics. The average of the frequencies of Hispanics in FY94 and FY89 is used as weight. Since the Army has 6.6 percent and the Marine Corps has 9.7 percent Hispanics on average, the predicted effects on attrition are different for these two services.

Table 26.
Changes in Marginal effects of Hispanics and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.0168	-0.0007	-0.0425	-0.0022	-0.0257	-0.0017
Navy	-0.0263	-0.0017	-0.0668	-0.0042	-0.0405	-0.0030
Air Force	0.0019	0.0000	-0.0187	-0.0006	-0.0206	-0.0008
Marine Corps	-0.0007	0.0000	-0.0260	-0.0019	-0.0253	-0.0024

Source: See Appendix C and Chapter V

Other Minorities:

Except for Air Force, there is an increasing trend in the magnitude of the marginal effects of "other minority" (American Indians, Alaskan Natives, and Asian Americans). That is, "other minorities" are not only less likely to attrite than whites in any one of the entry cohorts but also they are less likely to attrite with respect to earlier cohorts. This trend is most evident in the Army and the Navy. Other minorities in the Air Force and

the Marine Corps are closer to whites in terms of attrition risk than their counterparts in

the Army and the Navy.

Table 27.
Marginal effects of Other minorities by service, by entry cohort

	FY84	FY89	FY94
Army	-0.0739	-0.0832	-0.1289
Navy	-0.0699	-0.1392	-0.1606
Air Force	-0.0625	-0.0811	-0.0751
Marine Corps	-0.0589	-0.0532	-0.0724

Source: See Appendix C and Chapter V

The estimated effects of the changes on attrition are small due to the low

proportion of these minority groups in the samples. Although there is a 9 percentage

point decrease in the marginal effect between FY89 and FY84 in the Navy, the estimated

reduction on attrition is only 0.2 percentage point.

Table 28.
Changes in Marginal effects of Other minorities and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.0093	-0.0002	-0.0550	-0.0018	-0.0457	-0.0015
Navy	-0.0693	-0.0019	-0.0907	-0.0028	-0.0214	-0.0007
Air Force	-0.0186	-0.0004	-0.0126	-0.0004	0.0060	0.0002
Marine Corps	0.0057	0.0002	-0.0135	-0.0004	-0.0192	-0.0006

Source: See Appendix C and Chapter V

<u>NHGEDCRE (G.E.D. holders / non-high school graduates):</u>

As is clear from the Table 29, the "risk gap" between NHGEDCRE and high
school diploma graduates gets narrower over time and this gap is the smallest in the Air
Force. That is, G.E.D. holders/Non-high school graduates become less likely to attrite in
later cohorts.

Table 29.
Marginal effects of NHGEDCRE by service, by entry cohort

	FY84	FY89	FY94
Army	0.2249	0.1951	0.1580
Navy	0.2209	0.2090	0.1652
Air Force	0.1991	0.1608	0.0693
Marine Corps	0.2280	0.1545	0.1401

Source: See Appendix C and Chapter V

The biggest change takes place in the Air Force between 1994 and 1984. The
12.98 percentage point decrease in the marginal effect of NHGEDCRE during this period
is estimated to decrease attrition by 0.18 percentage points. However, this effect is much
smaller when compared to the 0.45 percentage point decrease estimated from a 7.35
percentage point decrease in the marginal effect in the Marine Corps between 1989 and
1984. Again, this is due to the difference in the representation of this group between
these years in each branch.

Table 30.
Changes in Marginal effects of NHGEDCRE and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.0298	-0.0036	-0.0669	-0.0064	-0.0371	-0.0039
Navy	-0.0119	-0.0011	-0.0557	-0.0038	-0.0438	-0.0042
Air Force	-0.0383	-0.0004	-0.1298	-0.0018	-0.0915	-0.0010
Marine Corps	-0.0735	-0.0045	-0.0879	-0.0044	-0.0144	-0.0008

Source: See Appendix C and Chapter V

AFQT scores:

As Table 31 shows there is a decreasing trend in the marginal effects of AFQT for

all services, except Air Force and Marine Corps from 1984 to 1989. This means that an

individual in the Army 1994 cohort with any AFQT score is less likely to attrite than an

individual in the 1989 and 1984 cohorts with the same score.

Table 31.
Marginal effects of AFQT scores by service, by entry cohort

	FY84	FY89	FY94
Army	-0.0011	-0.0014	-0.0021
Navy	-0.0017	-0.0017	-0.0022
Air Force	-0.0014	-0.0012	-0.0020
Marine Corps	-0.0017	-0.0012	-0.0021

Source: See Appendix C and Chapter V

As Table 32 shows, decreases in the marginal effects that take place between 1989 and 1994 and between 1994 and 1984 reduce attrition between these years. For the Army, the estimated decrease in attrition between 1994 and 1984 because of a 0.1 percentage point decrease in the marginal effect is 5.63 percentage points. For the other services, too, although the changes in marginal effects of AFQT are very small, the changes reduce attrition from 3.34 to 5.30 percentage points.

Table 32.
Changes in Marginal effects of AFQT scores and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	-0.0003	-0.0003	-0.0010	-0.0563	-0.0007	-0.0385
Navy	0.0000	0.0000	-0.0005	-0.0341	-0.0005	-0.0334
Air Force	0.0002	0.0002	-0.0006	-0.0371	-0.0008	-0.0530
Marine Corps	0.0005	0.0005	-0.0004	-0.0217	-0.0009	-0.0519

Source: See Appendix C and Chapter V

<u>Months in DEP:</u>

Table 33 shows that there is an increasing trend in the size of the marginal effects for the Army. This means that a person in the Army is more likely to attrite in later years than in earlier years if he or she spent the same time in DEP in both years. The trend in the Navy is opposite to the trend in the Army. There seems to be a decreasing trend in the USAF although it levels off in 1994. The marginal effects for USMC do not show a specific pattern. The estimated effects of changes in marginal effects on attrition rates range from 0 to 2.50 percentage points as shown in Table 34.

Table 33.

Marginal effects of months in DEP by service, by entry cohort

	FY84	FY89	FY94
Army	-0.0071	-0.0059	-0.0038
Navy	-0.0091	-0.0120	-0.0137
Air Force	-0.0091	-0.0057	-0.0057
Marine Corps	-0.0107	-0.0074	-0.0117

Source: See Appendix C and Chapter V

Table 34.

Changes in Marginal effects of months in DEP and
their estimated effect on attrition for three cohorts

	FY 84-89	effect	FY 84-94	effect	FY 89-94	effect
Army	0.0012	0.0043	0.0033	0.0118	0.0021	0.0071
Navy	-0.0029	-0.0139	-0.0046	-0.0250	-0.0017	-0.0082
Air Force	0.0034	0.0184	0.0034	0.0167	0.0000	0.0000
Marine Corps	0.0033	0.0188	-0.0010	-0.0051	-0.0043	-0.0238

Source: See Appendix C and Chapter V

Age at Entry:

Instead of presenting the marginal effects of seven age categories separately,

Table 35 shows the aggregate effects of age at entry. The effects in the table are obtained

by summing the individual effects resulting from the changes in the marginal effects of

the six age dummies. However, since the findings are not consistent in terms of both the

sign and the significance of the categories the effects in the table should be regarded

cautiously.

Table 35.
Estimated effects of the changes in the marginal
effects of age categories on attrition for three cohorts

	FY 84-89 effect	FY 84-94 effect	FY 89-94 effect
Army	-0.0099	-0.0152	-0.0050
Navy	-0.0024	-0.0148	-0.0170
Air Force	0.0014	-0.0022	-0.0037
Marine Corps	0.0067	-0.0013	-0.0091

Source: See Appendix C and Chapter V

V. OVERALL CHANGES IN ATTRITION DUE TO CHANGES IN X'S AND CHANGES IN B's (MARGINAL EFFECTS)

The attrition models built in Chapter III allow one to predict future cohort attrition rates. The decomposition technique used in this thesis asserts that both changes in the demographics (change in X's) and the changes in the marginal effects (change in B's) of a given cohort change the expected attrition rate of future cohorts. Thus, the sum of the estimated changes in attrition resulting from the changes in X's and B's predict the change in attrition for a given cohort. This chapter presents the results of the decomposition technique with respect to each service using only the 10-year period for the FY84 and FY94 cohorts. The results of the analysis that looks at the effects of the changes in X's and B's for the five-year periods between FY84 and FY89 and between FY89 and FY94 are presented in Appendix C.

A. ARMY

Table 36 presents the estimated effects of changing demographics between FY84 and FY94 on Army attrition. The predicted change in Army attrition for each variable is found by multiplying the change in the proportion (or mean) of X variables between the relevant years (X94 − X84) by the marginal effect in the earlier year (FY84). Then, the net estimated change in attrition due to the change in X's is calculated by summing the predicted changes for each variable.[3] The last column is obtained by dividing the predicted attrition due to the change in the proportion of the corresponding X variable (or

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[3] The sum of the expected changes due to the changes in each X or marginal effect might not equal the total expected change given in each table due to rounding.

the mean value of the variable if the variable is continuous) in the sample by the "actual attrition change" between these two years. Thus, the last column gives the opportunity to compare the magnitudes of the effects of each variable. For example, percent females increased 5.3 percentage points between 1984 and 1994 and this increase is estimated to increase attrition by 0.76 percentage points. 0.13 in the last column corresponding to females indicates that predicted increase in attrition due to the change in percent females explain 13 percent of the actual change in attrition between these years.

Table 36.
Expected changes in Army attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1443	0.125	0.178	0.053	0.00765	**0.13**
Black	-0.0888	0.239	0.234	-0.005	0.00044	0.01
Hisp	-0.0971	0.034	0.074	0.040	-0.00388	-0.07
Othermin	-0.0739	0.030	0.036	0.006	-0.00044	-0.01
NHGEDCRE	0.2249	0.112	0.081	-0.031	-0.00697	**-0.12**
Age17	0.0326	0.081	0.042	-0.039	-0.00127	-0.02
Age19	0.0134	0.232	0.244	0.012	0.00016	0.00
Age20	0.0051	0.117	0.147	0.030	0.00015	0.00
Age21	0.0168	0.063	0.092	0.029	0.00049	0.01
Age22	0.0283	0.039	0.060	0.021	0.00059	0.01
Age23+	0.0548	0.086	0.120	0.034	0.00186	0.03
AFQTPRCT	-0.0011	51.80	57.65	5.85	-0.00667	**-0.11**
Depmos	-0.0071	3.70	3.41	-0.29	0.00207	0.04
Total expected change =					**-0.00581**	

A 5.3 percentage point increase in the percent females, a 3.1 percentage point decrease in NHGEDCRE and a 5.85 point rise in AFQT scores affect attrition more than any other change between these years. As Table 36 shows, the expected increase in

attrition due to the rise in the percent females offsets the expected decrease in attrition due to the drop in the percent non-graduates. The net expected change due to the changes in all variables is a drop in attrition of 0.5 percentage points.

Table 37 gives the changes in the marginal effects between FY84 and FY94 and their effects. Expected changes in attrition due to the change in the marginal effect of each variable is weighted by the average value of the explanatory variable (X84 +X89 /2). Then, these separate effects for each X are summed to obtain the net effect on attrition due solely to changes in marginal effects between the two cohorts.

The change in the marginal effect of AFQT score alone reduces Army attrition by 5.63 percentage points. Also the amount of time spent in DEP in FY94 indicates greater attrition than it does in FY84, which is understood by the smaller size of the marginal effect in FY94. The change in the marginal effect of Depmos is predicted to increase the attrition rate between these years by 1.1 percentage points. The net estimated effect of the change in B's is a 7 percentage point decrease. The total estimated change between these years is the sum of –7 percentage points (due to change in B's) and –0.5 percentage points due to change in X's, which is a 7.5 percentage point drop in attrition. Considering the 5.8 percentage point increase in the actual attrition rate from FY84 to FY94, the 13.3 percentage point difference between the expected attrition rate and the actual attrition rate can not be explained by either the changes in X's or the changes in B's. This general pattern is repeated for the other three services.

Table 37.

Expected changes in Army attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1443	0.1373	-0.0070	0.125	0.178	0.152	-0.00106	-0.02
Black	-0.0888	-0.0851	0.0036	0.239	0.234	0.237	0.00086	0.01
Hisp	-0.0971	-0.1397	-0.0426	0.034	0.074	0.054	-0.00230	-0.04
Othermin	-0.0739	-0.1290	-0.0551	0.030	0.036	0.033	-0.00182	-0.03
NHGEDCRE	0.2249	0.1580	-0.0669	0.112	0.081	0.097	-0.00646	-0.11
Age17	0.0326	0.0094	-0.0231	0.081	0.042	0.062	-0.00142	-0.02
Age19	0.0134	0.0012	-0.0123	0.232	0.244	0.238	-0.00292	-0.05
Age20	0.0051	0.0043	-0.0008	0.117	0.147	0.132	-0.00010	0.00
Age21	0.0168	0.0023	-0.0145	0.063	0.092	0.078	-0.00112	-0.02
Age22	0.0283	-0.0026	-0.0309	0.039	0.060	0.050	-0.00153	-0.03
Age23+	0.0548	-0.0244	-0.0792	0.086	0.120	0.103	-0.00816	-0.14
AFQTPRCT	-0.0011	-0.0022	-0.0010	51.80	57.65	54.73	-0.05637	-0.97
Depmos	-0.0071	-0.0038	0.0033	3.70	3.41	3.56	0.01180	0.20

Total expected change =   **-0.07059**

B. NAVY

Table 38 presents the changes in demographics between FY84 and FY94 and their predicted effect on Navy attrition. The 6.79 point increase in AFQT scores is estimated to reduce attrition rate in FY84 by 1.14 percentage points. The percent NHGEDCRE

Table 38.
Expected changes in Navy attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0715	0.107	0.168	0.061	0.00436	0.04
Black	-0.0298	0.143	0.158	0.015	-0.00045	0.00
Hisp	-0.0245	0.054	0.073	0.019	-0.00046	0.00
Othermin	-0.0700	0.024	0.039	0.015	-0.00105	-0.01
NHGEDCRE	0.2202	0.077	0.063	-0.014	-0.00308	-0.03
Age17	0.0208	0.055	0.040	-0.015	-0.00031	0.00
Age19	0.0048	0.253	0.252	-0.001	0.00000	0.00
Age20	0.0121	0.130	0.136	0.006	0.00007	0.00
Age21	0.0056	0.074	0.074	0.000	0.00000	0.00
Age22	0.0110	0.044	0.048	0.004	0.00004	0.00
Age23+	0.0331	0.095	0.088	-0.007	-0.00023	0.00
AFQTPRCT	-0.0017	57.61	64.40	6.79	-0.01148	**-0.11**
Depmos	-0.0092	5.61	5.26	-0.35	0.00321	0.03
Total expected change =					**-0.00937**	

decreases 1.4 percentage points but this decrease brings about only a minor 0.3 percentage point decrease in the cohort attrition rate. About a 10 day decrease in average months in DEP offsets the effect of the drop in NHGEDCRE. The increase in the percent females is another factor that reduces the effect of rising AFQT scores. The overall expected change in attrition due solely to the changes in demographics is a 0.9 percentage

point decrease. Thus, if the marginal effects remained unchanged between these years and only the demographics changed the attrition rate in the Navy 1994 cohort would be 0.9 percentage points lower than it was in 1984 cohort.

Decreases in the marginal effect of AFQT score and months in DEP decrease attrition by 3.5 and 2.5 percentage points respectively. The other changes and their effects are as shown in Table 39. The expected change in attrition due to changes in the marginal effects is about a 9 percentage point decrease. The total expected change between these two cohorts is 9.9 percentage point decrease in attrition. That is, due to the changes in X's and the changes in marginal effects that took place between these two years decomposition technique predicts that the attrition rate in Navy 1994 cohort would be 9.9 percentage points less than the attrition rate in Navy 1984 cohort. However, the actual attrition rate between these years increased 10.5 percentage points. Thus, the overall 20.4 percentage point difference remains unexplained by the decomposition technique.

Table 39.

Expected changes in Navy attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0715	0.0280	-0.0435	0.107	0.168	0.138	-0.00598	-0.06
Black	-0.0298	-0.0194	0.0103	0.143	0.158	0.151	0.00156	0.01
Hisp	-0.0245	-0.0913	-0.0668	0.054	0.073	0.064	-0.00424	-0.04
Othermin	-0.0700	-0.1606	-0.0907	0.024	0.039	0.032	-0.00286	-0.03
NHGEDCRE	0.2202	0.1653	-0.0550	0.077	0.063	0.070	-0.00385	-0.04
Age17	0.0208	-0.0089	-0.0297	0.055	0.040	0.048	-0.00141	-0.01
Age19	0.0048	-0.0059	-0.0106	0.253	0.252	0.253	-0.00268	-0.03
Age20	0.0121	-0.0062	-0.0184	0.130	0.136	0.133	-0.00244	-0.02
Age21	0.0056	-0.0198	-0.0254	0.074	0.074	0.074	-0.00188	-0.02
Age22	0.0110	-0.0207	-0.0317	0.044	0.048	0.046	-0.00146	-0.01
Age23PLS	0.0331	-0.0214	-0.0545	0.095	0.088	0.092	-0.00499	-0.05
AFQTPRCT	-0.0017	-0.0023	-0.0006	57.61	64.40	61.01	-0.03416	**-0.33**
Depmos	-0.0092	-0.0138	-0.0046	5.61	5.26	5.44	-0.02506	**-0.24**

Total expected change = **-0.08945**

C.   AIR FORCE

As shown in Table 40, the expected change in attrition due to the changes in X's

between FY94 and FY84 is a decrease of only 0.1 percentage points. The percent

NHGEDCRE is the same in both years and consequently it does not affect attrition.

However, the proportion of this group in FY84 is 1.4 percent. Thus, even if the FY94

sample were composed only of high school diploma graduates the estimated decrease in

attrition would be 0.2 percentage points. The percent female increases by 9.7 percentage

points and the effect of this increase on attrition is a 0.77 percentage point increase.

Table 40.
Expected changes in Air Force attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0803	0.140	0.237	0.097	0.00779	**0.12**
Black	-0.0258	0.131	0.143	0.012	-0.00031	0.00
Hisp	-0.0825	0.022	0.049	0.027	-0.00223	-0.03
Other	-0.0625	0.024	0.040	0.016	-0.00100	-0.02
NHGEDCRE	0.1992	0.014	0.014	0.000	0.00000	0.00
Age17	0.0240	0.044	0.030	-0.014	-0.00034	-0.01
Age19	-0.0033	0.263	0.260	-0.003	0.00001	0.00
Age20	-0.0184	0.138	0.148	0.010	-0.00018	0.00
Age21	-0.0282	0.077	0.088	0.011	-0.00031	0.00
Age22	-0.0349	0.045	0.057	0.012	-0.00042	-0.01
Age23+	-0.0294	0.071	0.078	0.007	-0.00021	0.00
AFQTPRCT	-0.0015	60.95	65.00	4.05	-0.00603	-0.09
Depmos	-0.0092	4.96	4.80	-0.16	0.00147	0.02
Total expected change =					**-0.00176**	

Table 41 shows the changes in marginal effects and their effects on attrition. The changes that affect attrition most are the ones in the marginal effects of AFQT score and months in DEP. While the change in the marginal effect of AFQT reduce attrition by 3.7 percentage point the change in the marginal effect of Depmos increases attrition by 1.6 percentage point. The net expected change due to change in B's is –2.7 percentage points. Thus the overall expected change in attrition would be –2.8 percentage points, the sum of the expected changes due to changes in X's and changes in B's. The actual attrition rate between the two cohorts increased 6.6 percentage points and 9.4 percentage point difference between the expected change and the actual change remains unaccounted for by the decomposition technique.

D.   MARINE CORPS

The expected change in attrition due to the changes in X's is –0.8 percentage points as shown in Table 42. The biggest contributions to this change are made by the changes in the proportion of Hispanics (7.5 percentage point increase) and the AFQT scores (3.55 point increase). The other changes have minimal effects.

The changes in the marginal effects of the explanatory variables between these years decrease attrition by 3.6 percentage points as shown in Table 43. The change in the marginal effect of 0.04 percentage points of AFQT score has the biggest effect on attrition (2.1 percentage points decrease). The change in the marginal effect of AFQT score indicates that individuals with an AFQT score in Marine Corps 1994 cohort are less likely to attrite than the individuals with the same score in 1984 cohort after controlling for other characteristics. As a result of the changes in the demographics and relationships

63

Table 41.

Expected changes in Air Force attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0803	0.0712	-0.0091	0.140	0.237	0.189	-0.00171	-0.03
Black	-0.0258	-0.0265	-0.0007	0.131	0.143	0.137	-0.00010	0.00
Hisp	-0.0825	-0.1012	-0.0187	0.022	0.049	0.036	-0.00066	-0.01
Other	-0.0625	-0.0751	-0.0126	0.024	0.040	0.032	-0.00040	-0.01
NHGEDCRE	0.1992	0.0693	-0.1299	0.014	0.014	0.014	-0.00182	-0.03
Age17	0.0240	0.0198	-0.0042	0.044	0.030	0.037	-0.00016	0.00
Age19	-0.0033	-0.0045	-0.0012	0.263	0.260	0.262	-0.00031	0.00
Age20	-0.0184	-0.0154	0.0030	0.138	0.148	0.143	0.00043	0.01
Age21	-0.0282	-0.0495	-0.0212	0.077	0.088	0.083	-0.00175	-0.03
Age22	-0.0349	-0.0313	0.0036	0.045	0.057	0.051	0.00018	0.00
Age23+	-0.0294	-0.0376	-0.0082	0.071	0.078	0.075	-0.00061	-0.01
AFQTPRCT	-0.0015	-0.0021	-0.0006	60.95	65.00	62.98	-0.03716	**-0.56**
Depmos	-0.0092	-0.0057	0.0034	4.96	4.80	4.88	0.01679	**0.25**

Total expected change = **-0.02728**

between the explanatory variables and the attrition behavior, attrition in FY94 is estimated to be 4.4 percentage points less than the attrition rate in FY84. Yet, attrition rate between FY94 and FY84 increased 1.9 percentage points. The 6.3 percentage point difference between the expected and the actual changes is unaccounted for by the decomposition technique.

Table 42.
Expected changes in Marine Corps attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1533	0.049	0.055	0.006	0.00092	0.05
Black	-0.0288	0.172	0.131	-0.041	0.00118	0.06
Hisp	-0.0871	0.037	0.112	0.075	-0.00653	**-0.34**
Other	-0.0589	0.036	0.035	-0.001	0.00006	0.00
NHGEDCRE	0.2281	0.052	0.050	-0.002	-0.00046	-0.02
Age17	0.0249	0.077	0.047	-0.030	-0.00075	-0.04
Age19	0.0072	0.243	0.277	0.034	0.00025	0.01
Age20	0.0036	0.088	0.123	0.035	0.00013	0.01
Age21	0.0278	0.043	0.060	0.017	0.00047	0.02
Age22	0.0366	0.025	0.035	0.010	0.00037	0.02
Age23+	0.0513	0.036	0.049	0.013	0.00067	0.04
AFQTPRCT	-0.0018	53.87	57.42	3.55	-0.00628	**-0.33**
Depmos	-0.0108	5.45	5.30	-0.15	0.00161	0.08
Total expected change =					**-0.00837**	

Table 43.

Expected changes in Marine Corps attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1533	0.1113	-0.0420	0.049	0.055	0.052	-0.00218	-0.11
Black	-0.0288	-0.0203	0.0085	0.172	0.131	0.152	0.00129	0.07
Hisp	-0.0871	-0.1130	-0.0259	0.037	0.112	0.075	-0.00193	-0.10
Other	-0.0589	-0.0725	-0.0136	0.036	0.035	0.036	-0.00048	-0.03
NHGEDCRE	0.2281	0.1402	-0.0879	0.052	0.050	0.051	-0.00448	-0.24
Age17	0.0249	0.0260	0.0011	0.077	0.047	0.062	0.00007	0.00
Age19	0.0072	0.0069	-0.0003	0.243	0.277	0.260	-0.00008	0.00
Age20	0.0036	0.0257	0.0220	0.088	0.123	0.106	0.00232	0.12
Age21	0.0278	0.0001	-0.0276	0.043	0.060	0.052	-0.00142	-0.07
Age22	0.0366	0.0017	-0.0349	0.025	0.035	0.030	-0.00105	-0.06
Age23+	0.0513	0.0237	-0.0276	0.036	0.049	0.043	-0.00117	-0.06
AFQTPRCT	-0.0018	-0.0022	-0.0004	53.87	57.42	55.65	-0.02170	-1.14
Depmos	-0.0108	-0.0117	-0.0010	5.45	5.30	5.38	-0.00511	-0.27

Total expected change = **-0.03592**

VI.   SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A.   SUMMARY

Table 44 summarizes the findings of the decomposition technique for all four services using only the 1984 and 1994 cohorts as the beginning and end points. The decomposition technique predicts that attrition in the 1994 cohorts should have decreased with respect to the 1984 cohorts for all services. Instead, actual attrition rates increased between these years by the amounts shown in Table 43. The difference between the expected and the actual changes in attrition is the biggest for the Navy. While the Navy 1994 cohort attrition is predicted to be about 9.9 percentage points below the 1984 cohort attrition rate, the actual attrition rate in 1994 was 10.5 percentage points higher than the attrition rate in 1984. This 20.4 percentage point difference is unaccounted for by the decomposition technique.

Table 44.
Summary of decomposition analysis
by services for 1984 and 1989 cohorts (numbers in percentage points)

	The effect of changes in X's	The effect of changes in B's	Total expected change in attrition	Actual change in attrition
Army	-0.0058	-0.0706	-0.0764	0.058
Navy	-0.0093	-0.0894	-0.0987	0.105
Air Force	-0.0017	-0.0272	-0.0289	0.066
Marine Corps	-0.0083	-0.0359	-0.0442	0.019

Table 45 presents the expected effects of changes in X's, changes in B's, and the total expected changes in terms of percentages. In other words, the percentages indicate how much of the actual change in attrition is explained by the changes in X's, changes in B's and the total expected changes. That is, the percentages are obtained by dividing the predicted effects of changes in X's, changes in B's, and their totals by the actual change in attrition between 1984 and 1994. Negative signs indicate that predicted and actual changes are in opposite directions. For example, the changes in X's between 1984 and 1994 for the Army explain 10 percent of the actual change in attrition while changes in B's between the same years explain 122 percent of the actual change in attrition, although the direction of predicted and actual attrition is opposite. For all four services, changes in B's have greater predicted effects on attrition than changes in X's do.

Table 45.
Summary of decomposition analysis
reported as percentage of total actual change in attrition

	The effect of changes in X's	The effect of changes in B's	The effect of total expected change
Army	-10%	-122%	-132%
Navy	-9%	-85%	-94%
Air Force	-3%	-41%	-44%
Marine Corps	-44%	-189%	-233%

B. CONCLUSIONS

This study finds that in the cross sectional attrition models, all the explanatory variables except age at entry affect attrition consistently in terms of both expected signs and being statistically significant for all entry cohorts and services. Thus, it can be concluded that cross sectional data give reliable estimates of attrition. However, the insignificance of most of the age dummies, especially in the FY94 cohorts, and the finding that the individuals who are 17 years old have a greater attrition probability indicate that age may not be a good predictor of attrition.

The decomposition technique used in this thesis finds that when two entry cohorts are compared, the future cohorts have lower predicted attrition than the earlier cohorts. However, actual attrition rates increased over time for all services. The binary logit models built to estimate the relationship between the explanatory variables and attrition behavior for 12 entry cohorts explain about 70 percent of the attrition outcomes, based on classification tables. That is, the models have a good statistical power for estimating attrition behavior, with 70 percent of the cases classified correctly. However, this also suggests that some important variables may have been omitted from the models. These variables might be related to such unquantifiable factors as satisfaction with job assignment, or satisfaction with the military life style. Alternatively, as Buddin (1988) suggested, service-specific policies and even policies specific to each training facility may be important predictors.

One of the research questions this thesis seeks to answer is why attrition has not dropped given the substantial increase in recruit quality (increasing AFQT scores and

69

decreasing percentages of non-high school diploma graduates/G.E.D. holders) over time. The first portion of the decomposition technique, which estimates the change in attrition due to changes in the X's, finds that rises in quality (AFQT scores rise and the proportion of NHGEDCRE (non-grads) decrease) decreases attrition. For example, the proportion of non-grads/GED's dropped by 3.1 percentage points and AFQT scores rose 5.85 points between 1984 and 1994 in the Army. If no change had taken place in the other variables, this quality increase would have reduced attrition by 1.3 percentage points, using the formula discussed in Chapter III. However, the changes in other demographic factors dilute the effect of the greater quality. When all other demographic changes are considered the net change in attrition is only one half a percentage points decrease. This is because there are changes in the other X's that served to increase the attrition. Among these changes are the increase in the proportion of females and the decrease in months spent in the Delayed Entry Program (DEP). There are similar cases in other applications of the decomposition technique as illustrated in Chapter V and Appendix C.

The study also found that the change in marginal effects influence predicted attrition more than the change in X's. In most cases, the largest contribution to attrition is made by the trend in the marginal effect of AFQT scores. That is, individuals with a given AFQT score in a later cohort are much less likely to attrite than individuals with the same score in a previous cohort, after controlling for other characteristics.

C.   RECOMMENDATIONS

Further research is needed to identify "other factors" that cause attrition to rise over time. Buddin's (1988) study can be a good starting point in terms of identifying the

specific policies that have been implemented in each service at various times to reduce the attrition problem. After identifying some of the service-specific policies it may be possible to statistically analyze these policies. Further research is also needed to validate the use of entry age as a predictor of attrition.

Military policy makers should use marginal effects to predict future attrition rates of cohorts. As explained above, expectations of future attrition rates should take into account the changes not only in non-grads or AFQT scores but also in the other demographic characteristics, since changes in the other X's (e.g., change in months spent in DEP and in percent females) also have substantial effects on attrition. One can argue that recruiting higher quality recruits may not be worthwhile since the returns (lower attrition) may be small and the additional costs may be higher. However, considering the Army example discussed in the previous section, it is also plausible to assert that if AFQT scores did not increase and if the proportion of non-grads did not drop, the observed attrition would have been even higher than the actual increase of 5.8 percentage points between FY84 and FY94.

Thus, military policy makers should be more concerned with the trade-off between the predicted decrease of attrition and the increase in quality rather than with whether to recruit more "quality" recruits. For example, in the Army 1994 cohort 8.1 percent are non-grads/GED's and the average AFQT score is 57.6. If any one of the future Army entry cohorts were composed solely of high school diploma graduates and the average AFQT score rose to 65, the attrition rate in that cohort would decrease by 3.1 percentage points. This represents about a 10 percent decrease in attrition and means that for the Army about 3,000 fewer people would attrite. Correspondingly, this would

reduce the Army's accession by an equal number. Given that the FY98 Army recruiting shortfall was almost 7,000, this change would reduce the shortfall by half. However, raising quality this much would be costly to achieve, especially in the present recruiting environment.

The choice of the beginning and end dates used in this thesis (entry cohorts 1984, 1989, and 1994) is arbitrary. One might get different results if different beginning and end points were used. Thus, it is recommended that the decomposition analysis used in this thesis be replicated over periods with different beginning and end points. Also, the analysis could be applied to early military attrition (first six months) or to boot camp attrition.

APPENDIX A.   INTERSERVICE SEPARATION CODES

CODE		DESCRIPTION
00		RELEASE FROM ACTIVE SERVICE
	001	Expiration of Term of Service
	002	Early Release - Insufficient Retainability
	003	Early Release - To Attend School
	004	Early Release - Police Duty
	005	Early Release - In the National Interest
	006	Early Release - Seasonal Employment
	007	Early Release - To Teach
	008	Early Release - Other (Including RIF)
01		MEDICAL DISQUALIFICATIONS
	010	Conditions Existing Prior to Service
	011	Disability - Severance Pay
	012	Permanent Disability - Retired
	013	Temporary Disability - Retired
	014	Disability - Non EPTS - No Severance Pay
	015	Disability - Title 10 Retirement
	016	Unqualified for Active Duty - Other
	017	Failure to Meet Weight/Body Fat Standards (Included in O16 prior to FY85)
02		DEPENDENCY OR HARDSHIP
	022	Dependency or Hardship
03		DEATH
	030	Battle Casualty
	031	Non-Battle - Disease
	032	Non-Battle - Other
	033	Death - Cause not specified
04		ENTRY INTO OFFICER PROGRAMS
	040	Officer Commissioning Program
	041	Warrant Officer Program
	042	Service Academy

CODE		DESCRIPTION
05		RETIREMENT (OTHER THAN MEDICAL)
	050	20-30 Years of Service
	051	Over 30 Years of Service
	052	Other Categories
06		FAILURE TO MEET MINIMUM BEHAVIORAL AND PERFORMANCE CRITERIA
	060	Character or Behavior Disorder
	061	Motivational Problems
	062	Enuresis
	063	Inaptitude
	064	Alcoholism
	065	Discreditable Incidents - Civilian or Military
	066	Shirking
	067	Drugs
	068	Financial Irresponsibility
	069	Lack of Dependent Support
	070	Unsanitary Habits
	071	Civil Court Convictions
	072	Security
	073	Court Martial
	074	Fraudulent Entry
	075	AWOL, Desertion
	076	Homosexuality
	077	Sexual Perversion
	078	Good of the Service (In lieu of Court Martial)
	079	Juvenile Offender
	080	Misconduct (Reason Unknown)
	081	Unfitness (Reason Unknown)
	082	Unsuitability (Reason Unknown)
	083	Pattern of Minor Disciplinary Infractions
	084	Commission of a Serious Offense
	085	Failure to Meet Minimum Qualifications for Retention
	086	Expeditious Discharge/Unsatisfactory Performance
	087	Trainee Discharge/Entry Level Performance and Conduct

CODE		DESCRIPTION
09		OTHER SEPARATIONS OR DISCHARGES

	090	Secretarial Authority
	091	Erroneous Enlistment or Induction
	092	Sole Surviving Son
	093	Pregnancy
	094	Minority
	095	Conscientious Objector
	096	Parenthood
	097	Breach of Contract
	098	Other

10		TRANSACTIONS

	100	Immediate Reenlistment
	101	Dropped from Strength for Desertion
	102	Dropped from Strength for Imprisonment
	103	Record Correction
	104	Missing in Action or Captured
	105	Other Dropped from Strength/the Rolls

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APPENDIX B. COEFFICIENTS AND MARGINAL EFFECTS OF VARIABLES FOR EACH SERVICE AND ENTRY COHORT

Note: The coefficients and marginal effects of variables for 1989 cohorts for all four services are presented in Chapter IV. The rest of the appendix presents the coefficients and the marginal effects estimated from the binary logit models using maximum likelihood technique.

Table B.1
Coefficients and Marginal effects of
variables for Army 1984 and Army 1994 cohorts
Standard errors in paranthesis

Variables	Army 1984		Army 1994	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Intercept	-0.4812* (0.0257)	——	0.0808*** (0.0458)	——
Female	0.6319* (0.0197)	0.1443	0.5599* (0.0265)	0.1373
Black	-0.4845* (0.0176)	-0.0887	-0.3848* (0.0264)	-0.0851
Hispanics	-0.5374* (0.0404)	-0.0971	-0.6669* (0.0430)	-0.1396
Other min.	-0.3941* (0.0412)	-0.0739	-0.6084* (0.0594)	-0.1289
NHGEDCRE	0.9558* (0.0218)	0.2249	0.6430* (0.0369)	0.1580
Age 17	0.1536* (0.0261)	0.0325	0.0401 (0.0537)	0.0094
Age 19	0.0645* (0.0181)	0.0134	0.0049 (0.0290)	0.0017
Age 20	0.0244 (0.0230)	0.0050	0.0183 (0.0341)	0.0043
Age 21	0.0802* (0.0289)	0.0167	0.0183 (0.0400)	0.0023
Age 22	0.1341* (0.0354)	0.0283	-0.0111 (0.0471)	-0.0025
Age 23+	0.2538* (0.0253)	0.0548	-0.1056* (0.0369)	-0.0244
AFQTPRCT	-0.0055* (0.0003)	-0.0011	-0.0092* (0.0006)	-0.0021
Depmos	-0.0351* (0.0024)	-0.0071	-0.0164* (0.0038)	-0.0038
-2 Log L Sample size	130318 108,070		54378 42,055	

*   significant at 0.01 significance level
**   significant at 0.05 significance level
***   significant at 0.10 significance level

Table B.2
Coefficients and Marginal effects of
variables for Navy 1984 and Navy 1994 cohorts
Standard errors in paranthesis

Variables	Navy 1984		Navy 1994	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Intercept	-0.3365* (0.0367)	——	0.4274* (0.0534)	——
Female	0.3615* (0.0299)	0.0715	0.1177* (0.0306)	0.0280
Black	-0.1721* (0.0290)	-0.0297	-0.0835** (0.0328)	-0.0194
Hispanics	-0.1402* (0.0431)	-0.0244	-0.4135* (0.0465)	-0.0912
Other min.	-0.4363* (0.0679)	-0.0699	-0.7835* (0.0673)	-0.1606
NHGEDCRE	0.9964* (0.0339)	0.2202	0.6716* (0.0463)	0.1652
Age 17	0.1117** (0.0437)	0.0208	-0.0379 (0.0614)	-0.0088
Age 19	0.0261 (0.0255)	0.0047	-0.0250 (0.0304)	-0.0058
Age 20	0.0658** (0.0315)	0.0121	-0.0266 (0.0376)	-0.0062
Age 21	0.0304 (0.0394)	0.0055	-0.0852*** (0.0475)	-0.0198
Age 22	0.0597 (0.0486)	0.0110	-0.0892 (0.0570)	-0.0207
Age 23+	0.1748* (0.0352)	0.0331	-0.0920** (0.0448)	-0.0213
AFQTPRCT	-0.0093* (0.0005)	-0.0016	-0.0095* (0.0006)	-0.0022
Depmos	-0.0514* (0.0025)	-0.0091	-0.0591* (0.0034)	-0.0137
-2 Log L Sample size	64105 57,098		43149 33,515	

*   significant at 0.01 significance level
**   significant at 0.05 significance level
***   significant at 0.10 significance level

79

Table B.3
Coefficients and Marginal effects of
variables for Air Force 1984 and Air Force 1994 cohorts
Standard errors in paranthesis

	Air Force 1984		Air Force 1994	
		Marginal		Marginal
Variables	Coefficients	Effects	Coefficients	Effects
Intercept	-0.3515* (0.0478)	———	0.0206 (0.0666)	———
Female	0.3882* (0.0303)	0.0803	0.3090* (0.0298)	0.0712
Black	-0.1408* (0.0336)	-0.0257	-0.1233* (0.0378)	-0.0265
Hispanics	-0.4964* (0.0845)	-0.0824	-0.5105* (0.0657)	-0.1011
Other min.	-0.3622* (0.0775)	-0.0625	-0.3669* (0.0701)	-0.0751
NHGEDCRE	0.8889* (0.0845)	0.1991	0.3010* (0.1050)	0.0693
Age 17	0.1230** (0.0544)	0.0240	0.0887 (0.0756)	0.0198
Age 19	-0.0173 (0.0283)	-0.0032	-0.0203 (0.0337)	-0.0044
Age 20	-0.0996* (0.0355)	-0.0184	-0.0711*** (0.0409)	-0.0154
Age 21	-0.1548* (0.0451)	-0.0282	-0.2350* (0.0509)	-0.0494
Age 22	-0.1929* (0.0574)	-0.0348	-0.1461** (0.0598)	-0.0312
Age 23+	-0.1616* (0.0469)	-0.0294	-0.1767* (0.0531)	-0.0376
AFQTPRCT	-0.0078* (0.0006)	-0.0014	-0.0095* (0.0008)	-0.0020
Depmos	-0.0489* (0.0037)	-0.0091	-0.0262* (0.0040)	-0.0057
-2 Log L Sample size	48805 43,575		34710 27,949	

   *   significant at 0.01 significance level
  **   significant at 0.05 significance level
***   significant at 0.10 significance level

Table B.4
Coefficients and Marginal effects of
variables for Marine Corps 1984 and Marine Corps 1994 cohorts
Standard errors in paranthesis

Variables	Marine Corps 1984		Marine Corps 1994	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Intercept	-0.1406* (0.0495)	——	0.1192** (0.0565)	——
Female	0.6668* (0.0540)	0.1532	0.4749* (0.0536)	0.1112
Black	-0.1440* (0.0340)	-0.0287	-0.0940** (0.0385)	-0.0202
Hispanics	-0.4716* (0.0705)	-0.0870	-0.5829* (0.0447)	-0.1130
Other min.	-0.3061* (0.0687)	-0.0589	-0.3547* (0.0727)	-0.0724
NHGEDCRE	0.9669* (0.0536)	0.2280	0.5915* (0.0552)	0.1401
Age 17	0.1177** (0.0479)	0.0248	0.1163 (0.0624)	0.0259
Age 19	0.0347 (0.0311)	0.0072	0.0313 (0.0323)	0.0069
Age 20	0.0176 (0.0455)	0.0036	0.1148* (0.0425)	0.0256
Age 21	0.1310** (0.0608)	0.0277	0.0004 (0.0567)	0.0001
Age 22	0.1715** (0.0784)	0.0365	0.0079 (0.0716)	0.0017
Age 23+	0.2377* (0.0652)	0.0513	0.1064 (0.0615)	0.2374
AFQTPRCT	-0.0086* (0.0007)	-0.0017	-0.0098* (0.0007)	-0.0021
Depmos	-0.0527* (0.0033)	-0.0107	-0.0539* (0.0036)	-0.0117
-2 Log L Sample size	38602 32,044		35579 28,742	

*   significant at 0.01 significance level
**   significant at 0.05 significance level
***   significant at 0.10 significance level

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APPENDIX C. APPLICATION OF DECOMPOSITION TECHNIQUE TO 1984-1989 AND 1989-1994 COHORTS FOR ALL FOUR SERVICES

A.   ARMY

Application of decomposition technique to Army 1984 and 1989 cohorts:

Table 1 presents the estimated effects of changing demographics between FY84 and

FY89 on Army attrition. The net predicted change in attrition is a 0.15 percentage point

increase in the attrition rate between 1984 and 1989.[4] The two variables that affect

attrition more than others are the changes in the proportion of Blacks and GED

holders/non-high school graduates (NHGEDCRE). A 2 percentage point increase in the

proportion of NHGEDCRE is estimated to increase attrition in FY84 by 0.45 percentage

points. The increase in Blacks, however, is estimated to decrease attrition by 0.34

percentage points. These two effects almost cancel each other out. Also, while the

increase in AFQT scores and the increase in the proportion of Hispanics help decrease

attrition, an increase in females and a decrease in average months spent in DEP almost

negates their effects, yielding a net change very close to zero.

Table 2 gives the changes in the marginal effects between FY84 and FY89 and

their effects. It is estimated that the changes in the marginal effects of all variables bring

about a decrease in attrition except for the changes in the marginal effects of females and

months spent in DEP. The estimated attrition rate in FY89 due solely to the changes in

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[4] The total expected changes in each table might not equal the sum of the individual expected changes due to rounding.

the marginal effects would be the FY84 attrition rate plus the net effect of –2.75 percentage points.

The predicted change in attrition between these years equals the change due to the changes in X's plus the change due to the changes in B's. This gives an estimated decrease of 2.60 percentage points in the attrition rate between 1984 and 1989. However, between these years attrition actually rose 3.2 percentage points. The 5.79 percentage point difference between predicted and actual attrition rate can not be explained either by change in X's or change in B's.

Table C.1
Expected changes in Army attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1443	0.125	0.141	0.016	0.00231	0.07
Black	-0.0888	0.239	0.278	0.039	-0.00346	**-0.11**
Hisp	-0.0971	0.034	0.058	0.024	-0.00233	-0.07
Othermin	-0.0739	0.030	0.031	0.001	-0.00007	0.00
NHGEDCRE	0.2249	0.112	0.132	0.020	0.00450	**0.14**
Age17	0.0326	0.081	0.067	-0.014	-0.00046	-0.01
Age19	0.0134	0.232	0.238	0.006	0.00008	0.00
Age20	0.0051	0.117	0.128	0.011	0.00006	0.00
Age21	0.0168	0.063	0.072	0.009	0.00015	0.00
Age22	0.0283	0.039	0.047	0.008	0.00023	0.01
Age23+	0.0548	0.086	0.104	0.018	0.00099	0.03
AFQTPRCT	-0.0011	51.80	54.00	2.20	-0.00251	-0.08
Depmos	-0.0071	3.70	3.41	-0.29	0.00207	0.06
Total expected change =					**0.00155**	

Table C.2
Expected changes in Army attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1443	0.1544	0.0100	0.125	0.141	0.133	0.00133	0.04
Black	-0.0888	-0.0910	-0.0023	0.239	0.278	0.259	-0.00058	-0.02
Hisp	-0.0971	-0.1139	-0.0168	0.034	0.058	0.046	-0.00077	-0.02
Othermin	-0.0739	-0.0832	-0.0093	0.030	0.031	0.031	-0.00028	-0.01
NHGEDCRE	0.2249	0.1951	-0.0298	0.112	0.132	0.122	-0.00364	-0.11
Age17	0.0326	0.0219	-0.0106	0.081	0.067	0.074	-0.00079	-0.02
Age19	0.0134	0.0028	-0.0107	0.232	0.238	0.235	-0.00251	-0.08
Age20	0.0051	0.0027	-0.0023	0.117	0.128	0.123	-0.00029	-0.01
Age21	0.0168	0.0074	-0.0093	0.063	0.072	0.068	-0.00063	-0.02
Age22	0.0283	0.0132	-0.0151	0.039	0.047	0.043	-0.00065	-0.02
Age23+	0.0548	0.0018	-0.0530	0.086	0.104	0.095	-0.00504	-0.16
AFQTPRCT	-0.0011	-0.0015	-0.0003	51.80	54.00	52.90	-0.01799	-0.56
Depmos	-0.0071	-0.0059	0.0012	3.70	3.41	3.56	0.00434	0.14

Total expected change = -0.02750

Application of decomposition technique to Army 1989 and 1994 cohorts:

The net effect predicted by the changes in demographics is a minor 0.8 percentage point decrease in attrition. The decreasing percent of non-graduates/GED holders and increasing AFQT scores are expected to decrease attrition while the increasing percent of females and decreasing percent of blacks are expected to increase attrition by the amounts shown in Table 3. The change in the proportion of NHGEDCRE affects attrition more than any other variables.

As Table 4 shows, the change in the marginal effect of AFQT scores makes the biggest contribution to the expected decrease in attrition. Also, the fact that the individuals who spent some time in DEP in 1994 are more likely to attrite than those who spent the same time in 1989 increases attrition in 1989 by 0.71 percentage point. The change in the marginal effect of DEP gives the second biggest effect on attrition. The expected attrition rate in FY94 in the Army due to the changes in marginal effects is the attrition rate of 34.9 % in FY89 plus – 4.48 percentage points, which is 30.4 %. The total predicted change in attrition would be a 5.28 percentage point decrease between 1989 and 1994. The actual attrition rate between these years increased 2.6 percentage points. The 7.88 percentage point difference between the predicted and the actual attrition rates can not be explained by the decomposition technique.

Table C.3
Expected changes in Army attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1544	0.141	0.178	0.037	0.00571	**0.22**
Black	-0.0910	0.278	0.234	-0.044	0.00400	0.15
Hisp	-0.1139	0.058	0.074	0.016	-0.00182	-0.07
Othermin	-0.0832	0.031	0.036	0.005	-0.00042	-0.02
NHGEDCRE	0.1951	0.132	0.081	-0.051	-0.00995	**-0.38**
Age17	0.0219	0.067	0.042	-0.025	-0.00055	-0.02
Age19	0.0028	0.238	0.244	0.006	0.00002	0.00
Age20	0.0027	0.128	0.147	0.019	0.00005	0.00
Age21	0.0074	0.072	0.092	0.020	0.00015	0.01
Age22	0.0132	0.047	0.060	0.013	0.00017	0.01
Age23+	0.0018	0.104	0.120	0.016	0.00003	0.00
AFQTPRCT	-0.0015	54.00	57.65	3.65	-0.00540	**-0.21**
Depmos	-0.0059	3.41	3.41	0.00	0.00000	0.00
Total expected change =					**-0.00801**	

Table C.4

Expected changes in Army attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1544	0.1373	-0.0170	0.141	0.178	0.160	-0.00272	-0.10
Black	-0.0910	-0.0851	0.0059	0.278	0.234	0.256	0.00151	0.06
Hisp	-0.1139	-0.1397	-0.0258	0.058	0.074	0.066	-0.00170	-0.07
Othermin	-0.0832	-0.1290	-0.0457	0.031	0.036	0.034	-0.00153	-0.06
NHGEDCRE	0.1951	0.1580	-0.0371	0.132	0.081	0.107	-0.00395	-0.15
Age17	0.0219	0.0094	-0.0125	0.067	0.042	0.055	-0.00068	-0.03
Age19	0.0028	0.0012	-0.0016	0.238	0.244	0.241	-0.00038	-0.01
Age20	0.0027	0.0043	0.0016	0.128	0.147	0.138	0.00022	0.01
Age21	0.0074	0.0023	-0.0051	0.072	0.092	0.082	-0.00042	-0.02
Age22	0.0132	-0.0026	-0.0158	0.047	0.060	0.054	-0.00084	-0.03
Age23+	0.0018	-0.0244	-0.0262	0.104	0.120	0.112	-0.00293	-0.11
AFQTPRCT	-0.0015	-0.0022	-0.0007	54.00	57.65	55.83	-0.03852	-1.48
Depmos	-0.0059	-0.0038	0.0021	3.41	3.41	3.41	0.00716	0.28

Total expected change = -0.0448

B.   NAVY

Application of decomposition technique to Navy 1984 and 1989 cohorts:

The change in demographics is predicted to increase attrition by 2.57 percentage

points as shown in Table 5. The increase in the proportion of NHGEDCRE and the

decrease in the months spent in DEP between these years explain the biggest portion of

the predicted increase in attrition.

Table C.5
Expected changes in Navy attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0715	0.107	0.133	0.026	0.00186	0.02
Black	-0.0298	0.143	0.202	0.059	-0.00176	-0.02
Hisp	-0.0245	0.054	0.079	0.025	-0.00061	-0.01
Othermin	-0.0700	0.024	0.031	0.007	-0.00049	-0.01
NHGEDCRE	0.2202	0.077	0.133	0.056	0.01233	**0.16**
Age17	0.0208	0.055	0.068	0.013	0.00027	0.00
Age19	0.0048	0.253	0.239	-0.014	-0.00007	0.00
Age20	0.0121	0.130	0.116	-0.014	-0.00017	0.00
Age21	0.0056	0.074	0.064	-0.010	-0.00006	0.00
Age22	0.0110	0.044	0.041	-0.003	-0.00003	0.00
Age23+	0.0331	0.095	0.099	0.004	0.00013	0.00
AFQTPRCT	-0.0017	57.61	57.13	-0.48	0.00081	0.01
Depmos	-0.0092	5.61	4.14	-1.47	0.01349	**0.17**
Total expected change =					**0.02572**	

The estimated effect of changes in B's between FY84 and FY89 is a 1.6

percentage point decrease in attrition. The largest contribution to this decrease is made

by the change in the marginal effect of months spent in DEP. The total predicted change

Table C.6
Expected changes in Navy attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0715	0.0877	0.0162	0.107	0.133	0.120	0.00194	0.02
Black	-0.0298	-0.0367	-0.0070	0.143	0.202	0.173	-0.00120	-0.02
Hisp	-0.0245	-0.0507	-0.0263	0.054	0.079	0.067	-0.00175	-0.02
Othermin	-0.0700	-0.1392	-0.0693	0.024	0.031	0.028	-0.00190	-0.02
NHGEDCRE	0.2202	0.2091	-0.0112	0.077	0.133	0.105	-0.00117	-0.02
Age17	0.0208	0.0379	0.0171	0.055	0.068	0.062	0.00105	0.01
Age19	0.0048	0.0127	0.0079	0.253	0.239	0.246	0.00195	0.02
Age20	0.0121	0.0052	-0.0069	0.130	0.116	0.123	-0.00085	-0.01
Age21	0.0056	0.0068	0.0012	0.074	0.064	0.069	0.00008	0.00
Age22	0.0110	0.0170	0.0059	0.044	0.041	0.043	0.00025	0.00
Age23PLS	0.0331	0.0327	-0.0004	0.095	0.099	0.097	-0.00004	0.00
AFQTPRCT	-0.0017	-0.0017	0.0000	57.61	57.13	57.37	-0.00057	-0.01
Depmos	-0.0092	-0.0120	-0.0029	5.61	4.14	4.88	-0.01394	-0.18

Total expected change =   -0.01616

between these years is an increase in attrition of 0.9 percentage points. However, actual increase in attrition is 7.8 percentage points. 6.9 percentage point difference can not be explained by the decomposition technique.

Application of decomposition technique to Navy 1989 and 1994 cohorts:

The effects of the changes in X's are shown in Table 7. The 7 percentage point decrease in the proportion of NHGEDCRE results in about 1.5 percentage point decrease in attrition and makes the biggest contribution to the total predicted change of −3.7 percentage points. The other changes that are expected to affect attrition significantly are the 7.27 point increase in AFQT scores and almost 1 month increase in average months spent in DEP between these years.

As Table 8 shows, the marginal effects of all variables except of Black change in a way that results in a predicted decrease in attrition. The change in the marginal effect of AFQT scores is estimated to decrease attrition by 3.3 percentage points. The net expected change in attrition due to the change in B's is − 7.2 percentage points. Thus decomposition technique shows that attrition should have gone down by 10.9 percentage points. The actual attrition rate between these years, however, increased 2.7 percentage points. 13.6 percentage point difference between the predicted and the actual changes is unaccounted for by the decomposition technique.

Table C.7
Expected changes in Navy attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.0877	0.133	0.168	0.035	0.00307	0.11
Black	-0.0367	0.202	0.158	-0.044	0.00162	0.06
Hisp	-0.0507	0.079	0.073	-0.006	0.00030	0.01
Othermin	-0.1392	0.031	0.039	0.008	-0.00111	-0.04
NHGEDCRE	0.2091	0.133	0.063	-0.070	-0.01463	**-0.54**
Age17	0.0379	0.068	0.040	-0.028	-0.00106	-0.04
Age19	0.0127	0.239	0.252	0.013	0.00016	0.01
Age20	0.0052	0.116	0.136	0.020	0.00010	0.00
Age21	0.0068	0.064	0.074	0.010	0.00007	0.00
Age22	0.0170	0.041	0.048	0.007	0.00012	0.00
Age23+	0.0327	0.099	0.088	-0.011	-0.00036	-0.01
AFQTPRCT	-0.0017	57.13	64.40	7.27	-0.01236	**-0.46**
Depmos	-0.0120	4.14	5.26	1.12	-0.01348	**-0.50**
Total expected change =					**-0.03757**	

C. AIR FORCE

Application of decomposition technique to Air Force 1984 and 1989 cohorts:

The change in AFQT scores and months spent in DEP bring about more change in attrition than other variables as shown in Table 9. The 5 point rise in AFQT scores indicates a significant increase in recruit quality between these years.However, the expected decrease in attrition because of this rise in AFQT scores is only 0.7 percentage points. Also about 1 month increase in time spent in DEP is estimated to result in a 0.8 percentage point decrease in attrition. As a result of these changes in explanatory

Table C.8
Expected changes in Navy attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0877	0.0280	-0.0597	0.133	0.168	0.151	-0.00898	**-0.33**
Black	-0.0367	-0.0194	0.0173	0.202	0.158	0.180	0.00312	0.12
Hisp	-0.0507	-0.0913	-0.0406	0.079	0.073	0.076	-0.00308	-0.11
Othermin	-0.1392	-0.1606	-0.0214	0.031	0.039	0.035	-0.00075	-0.03
NHGEDCRE	0.2091	0.1653	-0.0438	0.133	0.063	0.098	-0.00429	-0.16
Age17	0.0379	-0.0089	-0.0468	0.068	0.040	0.054	-0.00253	-0.09
Age19	0.0127	-0.0059	-0.0186	0.239	0.252	0.246	-0.00455	-0.17
Age20	0.0052	-0.0062	-0.0115	0.116	0.136	0.126	-0.00144	-0.05
Age21	0.0068	-0.0198	-0.0266	0.064	0.074	0.069	-0.00183	-0.07
Age22	0.0170	-0.0207	-0.0377	0.041	0.048	0.045	-0.00168	-0.06
Age23PLS	0.0327	-0.0214	-0.0541	0.099	0.088	0.094	-0.00506	-0.19
AFQTPRCT	-0.0017	-0.0023	-0.0005	57.13	64.40	60.77	-0.03342	**-1.24**
Depmos	-0.0120	-0.0138	-0.0018	4.14	5.26	4.70	-0.00823	**-0.30**
					Total expected change =		-0.07273	

Table C.9
Expected changes in Air Force attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0803	0.140	0.211	0.071	0.00570	**0.14**
Black	-0.0258	0.131	0.126	-0.005	0.00013	0.00
Hisp	-0.0825	0.022	0.034	0.012	-0.00099	-0.02
Other	-0.0625	0.024	0.026	0.002	-0.00013	0.00
NHGEDCRE	0.1992	0.014	0.010	-0.004	-0.00080	-0.02
Age17	0.0240	0.044	0.028	-0.016	-0.00038	-0.01
Age19	-0.0033	0.263	0.256	-0.007	0.00002	0.00
Age20	-0.0184	0.138	0.134	-0.004	0.00007	0.00
Age21	-0.0282	0.077	0.079	0.002	-0.00006	0.00
Age22	-0.0349	0.045	0.049	0.004	-0.00014	0.00
Age23+	-0.0294	0.071	0.090	0.019	-0.00056	-0.01
AFQTPRCT	-0.0015	60.95	65.90	4.95	-0.00738	**-0.18**
Depmos	-0.0092	4.96	5.90	0.94	-0.00862	**-0.21**
Total expected change =					**-0.01312**	

Table 10 presents the changes in marginal effects and their predicted effect on attrition. The greatest portions of the net expected increase of 3.4 percentage points in attrition due solely to changes in B's are explained by the changes in B's of AFQT scores and the months in DEP. The effect of AFQT scores is a 1.4 percentage points while the effect of months in DEP is 1.8 percentage points.

The decomposition technique predicts a 2.1 percentage point increase in attrition between FY89 and FY84 for Air Force, as calculated by the sum of the predicted effects of change in X's and change in B's. Since the actual increase in attrition between these

Table C.10

Expected changes in Air Force attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0803	0.1201	0.0398	0.140	0.211	0.176	0.00699	0.17
Black	-0.0258	-0.0712	-0.0455	0.131	0.126	0.129	-0.00584	-0.14
Hisp	-0.0825	-0.0805	0.0019	0.022	0.034	0.028	0.00005	0.00
Other	-0.0625	-0.0812	-0.0187	0.024	0.026	0.025	-0.00047	-0.01
NHGEDCRE	0.1992	0.1609	-0.0383	0.014	0.010	0.012	-0.00046	-0.01
Age17	0.0240	0.0063	-0.0177	0.044	0.028	0.036	-0.00064	-0.02
Age19	-0.0033	0.0057	0.0089	0.263	0.256	0.260	0.00232	0.06
Age20	-0.0184	-0.0146	0.0039	0.138	0.134	0.136	0.00053	0.01
Age21	-0.0282	-0.0209	0.0073	0.077	0.079	0.078	0.00057	0.01
Age22	-0.0349	-0.0366	-0.0018	0.045	0.049	0.047	-0.00008	0.00
Age23+	-0.0294	-0.0455	-0.0161	0.071	0.090	0.081	-0.00129	-0.03
AFQTPRCT	-0.0015	-0.0013	0.0002	60.95	65.90	63.43	0.01395	0.33
Depmos	-0.0092	-0.0058	0.0034	4.96	5.90	5.43	0.01846	0.44
						Total expected change =	0.03410	

95

years is 4.2 percentage points, it can be inferred that the decomposition technique accounts for 50

% of the change that took place. The other 50 % is unaccounted for.

Application of decomposition technique to Air Force 1989 and 1994 cohorts:

The changes in the demographics between 1989 and 1994 for Air Force are

expected to result in an increase in attrition of 0.7 percentage points as shown in Table

11. The two changes that are predicted to affect attrition more than the other variables

are the change in the percent females and the change in the months spent in DEP. As the

table clearly shows the quality between these years worsened. The percent NHGEDCRE

increased and the AFQT scores dropped. Although their effects are small, they help

increase attrition.

Table C.11
Expected changes in Air Force attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1201	0.211	0.237	0.026	0.00312	**0.13**
Black	-0.0712	0.126	0.143	0.017	-0.00121	-0.05
Hisp	-0.0805	0.034	0.049	0.015	-0.00121	-0.05
Other	-0.0812	0.026	0.040	0.014	-0.00114	-0.05
NHGEDCRE	0.1609	0.010	0.014	0.004	0.00064	0.03
Age17	0.0063	0.028	0.030	0.002	0.00001	0.00
Age19	0.0057	0.256	0.260	0.004	0.00002	0.00
Age20	-0.0146	0.134	0.148	0.014	-0.00020	-0.01
Age21	-0.0209	0.079	0.088	0.009	-0.00019	-0.01
Age22	-0.0366	0.049	0.057	0.008	-0.00029	-0.01
Age23+	-0.0455	0.090	0.078	-0.012	0.00055	0.02
AFQTPRCT	-0.0013	65.90	65.00	-0.90	0.00114	0.05
Depmos	-0.0058	5.90	4.80	-1.10	0.00635	**0.26**
Total expected change =					**0.00760**	

Table 12 shows the effects of the changes in marginal effects between 1989 and 1994. As understood by the signs of the change in the marginal effects, females and individuals with higher AFQT scores are less likely to attrite in FY94 than they are in FY89. These changes result in an expected decrease in attrition between these years. The change in the B's of AFQT scores and females bring about 5.3 and 1 percentage point decreases respectively. The net change due to change in B's is –6.3 percentage points. The overall expected change in attrition is 5.6 percentage point decrease, –6.3 percentage point due to change in B's plus 0.7 percentage point due to change in X's. There is a 8 percentage point difference between the expected and the actual changes in attrition. This difference is not explained by the decomposition technique.

Table C.12

Expected changes in Air Force attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1201	0.0712	-0.0489	0.211	0.237	0.224	-0.01095	-0.46
Black	-0.0712	-0.0265	0.0447	0.126	0.143	0.135	0.00601	0.25
Hisp	-0.0805	-0.1012	-0.0206	0.034	0.049	0.042	-0.00086	-0.04
Other	-0.0812	-0.0751	0.0061	0.026	0.040	0.033	0.00020	0.01
NHGEDCRE	0.1609	0.0693	-0.0915	0.010	0.014	0.012	-0.00110	-0.05
Age17	0.0063	0.0198	0.0135	0.028	0.030	0.029	0.00039	0.02
Age19	0.0057	-0.0045	-0.0101	0.256	0.260	0.258	-0.00262	-0.11
Age20	-0.0146	-0.0154	-0.0009	0.134	0.148	0.141	-0.00012	-0.01
Age21	-0.0209	-0.0495	-0.0285	0.079	0.088	0.084	-0.00238	-0.10
Age22	-0.0366	-0.0313	0.0053	0.049	0.057	0.053	0.00028	0.01
Age23+	-0.0455	-0.0376	0.0079	0.090	0.078	0.084	0.00066	0.03
AFQTPRCT	-0.0013	-0.0021	-0.0008	65.90	65.00	65.45	-0.05301	-2.21
Depmos	-0.0058	-0.0057	0.0000	5.90	4.80	5.35	0.00021	0.01

Total expected change = -0.06328

D. MARINE CORPS

Application of decomposition technique to Marine Corps 1984 and 1989 cohorts:

2-percentage point increase in the proportion of NHGEDCRE is estimated to increase attrition by 0.4 percentage point. 12-day increase in time spent in DEP is estimated to cancel out the effect resulted from the increase in NHGEDCRE. The effects of other changes are as shown in Table 13. The expected change in attrition due to the change in X's is a 0.5 percentage point decrease.

Table C.13
Expected changes in Marine Corps attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1533	0.049	0.065	0.016	0.00245	0.22
Black	-0.0288	0.172	0.194	0.022	-0.00063	-0.06
Hisp	-0.0871	0.037	0.081	0.044	-0.00383	-0.35
Other	-0.0589	0.036	0.036	0.000	0.00000	0.00
NHGEDCRE	0.2281	0.052	0.072	0.020	0.00456	**0.41**
Age17	0.0249	0.077	0.060	-0.017	-0.00042	-0.04
Age19	0.0072	0.243	0.271	0.028	0.00020	0.02
Age20	0.0036	0.088	0.099	0.011	0.00004	0.00
Age21	0.0278	0.043	0.046	0.003	0.00008	0.01
Age22	0.0366	0.025	0.025	0.000	0.00000	0.00
Age23+	0.0513	0.036	0.038	0.002	0.00010	0.01
AFQTPRCT	-0.0018	53.87	55.56	1.69	-0.00299	-0.27
Depmos	-0.0108	5.45	5.88	0.43	-0.00462	**-0.42**
Total expected change =					**-0.0051**	

Individuals with similar mental aptitudes (AFQT scores) in both years are more likely to attrite in FY89 than they are in FY84 as shown in Table 14. This results in an estimated increase in attrition of 2.9 percentage points. Also individuals who spent the same time in DEP in FY89 as they did in FY84 became more likely to attrite in FY89. This fact is estimated to increase attrition by 1.8 percentage points. The other changes do not affect attrition significantly. The net expected change in attrition due to changes in B's is an increase of 5.8 percentage points. The decomposition technique predicts that attrition should have increased 5.3 percentage points. However real attrition rate increased 1.1 percentage point. Thus, 4.2 percentage point difference is unaccounted for.

Table C.14

Expected changes in Marine Corps attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1533	0.1929	0.0397	0.049	0.065	0.057	0.00226	0.21
Black	-0.0288	0.0061	0.0349	0.172	0.194	0.183	0.00639	0.58
Hisp	-0.0871	-0.0877	-0.0006	0.037	0.081	0.059	-0.00004	0.00
Other	-0.0589	-0.0533	0.0056	0.036	0.036	0.036	0.00020	0.02
NHGEDCRE	0.2281	0.1546	-0.0735	0.052	0.072	0.062	-0.00456	-0.41
Age17	0.0249	0.0149	-0.0099	0.077	0.060	0.069	-0.00068	-0.06
Age19	0.0072	0.0187	0.0115	0.243	0.271	0.257	0.00295	0.27
Age20	0.0036	0.0224	0.0187	0.088	0.099	0.094	0.00175	0.16
Age21	0.0278	0.0391	0.0113	0.043	0.046	0.045	0.00050	0.05
Age22	0.0366	0.0378	0.0012	0.025	0.025	0.025	0.00003	0.00
Age23+	0.0513	0.1104	0.0590	0.036	0.038	0.037	0.00218	0.20
AFQTPRCT	-0.0018	-0.0012	0.0005	53.87	55.56	54.72	0.02900	2.64
Depmos	-0.0108	-0.0074	0.0033	5.45	5.88	5.67	0.01881	1.71

Total expected change =   0.05880

101

Application of decomposition technique to Marine Corps 1989 and 1994

cohorts:

The changes in X's and their estimated effects on attrition are shown in table 15. The expected decrease in attrition of 0.3 percentage points that result from a decrease in NHGEDCRE is canceled out by the expected increase of 0.4 percentage points that result from a decrease in the months spent in DEP. The decrease in percent females, the increase in percent Blacks, the increase in percent Hispanics, and the increase in AFQT scores help decrease attrition. However, the net estimated change due to the changes in X's is a minor decrease of –0.3 percentage points.

Table C.15
Expected changes in Marine Corps attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1929	0.065	0.055	-0.010	-0.00193	-0.24
Black	0.0061	0.194	0.131	-0.063	-0.00038	-0.05
Hisp	-0.0877	0.081	0.112	0.031	-0.00272	-0.34
Other	-0.0533	0.036	0.035	-0.001	0.00005	0.01
NHGEDCRE	0.1546	0.072	0.050	-0.022	-0.00340	**-0.43**
Age17	0.0149	0.060	0.047	-0.013	-0.00019	-0.02
Age19	0.0187	0.271	0.277	0.006	0.00011	0.01
Age20	0.0224	0.099	0.123	0.024	0.00054	0.07
Age21	0.0391	0.046	0.060	0.014	0.00055	0.07
Age22	0.0378	0.025	0.035	0.010	0.00038	0.05
Age23+	0.1104	0.038	0.049	0.011	0.00121	0.15
AFQTPRCT	-0.0012	55.56	57.42	1.86	-0.00231	-0.29
Depmos	-0.0074	5.88	5.30	-0.58	0.00431	**0.54**
Total expected change =					**-0.00378**	

Table 16 presents the changes in marginal effects and their estimated effects on attrition. The expected effects of changes in the marginal effects of all variables are negative except the age17 group. This indicates that of individuals with the same characteristics in both years the ones in FY94 are less likely to attrite than the ones in FY89. Consequently, the expected decrease in attrition due solely to changes in the marginal effects is 9.8 percentage points.

As a result of the changes in the X's and changes in the B's the expected attrition rate in FY94 would be 10.1 percentage point lower than the attrition rate in FY89. But the attrition rate increased 0.8 percentage point between these two entry cohorts. The 10.9 percentage point difference between the expected change and the actual change in attrition is unaccounted for.

Table C.16

Expected changes in Marine Corps attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1929	0.1113	-0.0817	0.065	0.055	0.060	-0.00490	-0.61
Black	0.0061	-0.0203	-0.0264	0.194	0.131	0.163	-0.00428	-0.54
Hisp	-0.0877	-0.1130	-0.0253	0.081	0.112	0.097	-0.00244	-0.30
Other	-0.0533	-0.0725	-0.0192	0.036	0.035	0.036	-0.00068	-0.09
NHGEDCRE	0.1546	0.1402	-0.0144	0.072	0.050	0.061	-0.00088	-0.11
Age17	0.0149	0.0260	0.0111	0.060	0.047	0.054	0.00059	0.07
Age19	0.0187	0.0069	-0.0118	0.271	0.277	0.274	-0.00322	-0.40
Age20	0.0224	0.0257	0.0033	0.099	0.123	0.111	0.00036	0.05
Age21	0.0391	0.0001	-0.0390	0.046	0.060	0.053	-0.00207	-0.26
Age22	0.0378	0.0017	-0.0361	0.025	0.035	0.030	-0.00108	-0.14
Age23+	0.1104	0.0237	-0.0866	0.038	0.049	0.044	-0.00377	-0.47
AFQTPRCT	-0.0012	-0.0022	-0.0009	55.56	57.42	56.49	-0.05197	-6.50
Depmos	-0.0074	-0.0117	-0.0043	5.88	5.30	5.59	-0.02387	-2.98

Total expected change =   **-0.09821**

104

E. SUMMARY OF DECOMPOSITION TECHNIQUE

FOR 1984-1989 COHORTS:

Table 17 presents a comparison of predicted changes by decomposition technique with the actual changes in attrition between 1984 and 1989. Different from the decomposition results presented in Chapter VI for 1984 and 1994 cohorts, the decomposition technique predicts an increase in attrition for the Navy, Air Force, and Marine Corps.

Table C.17
Summary of decomposition analysis
by services for 1984 and 1989 cohorts (numbers in percentage points)

	The effect of changes in X's	The effect of changes in B's	Total expected change in attrition	Actual change in attrition
Army	0.0015	-0.0275	-0.0260	0.032
Navy	0.0257	-0.0161	0.0096	0.078
Air Force	-0.0131	0.0341	0.0210	0.042
Marine Corps	-0.0051	0.0588	0.0537	0.011

Percentages in Table 18 show the proportion of predicted changes to the actual changes. For example, decomposition technique explains 50 percent of the actual change that took place between these years.

Table C.18
Summary of decomposition analysis for 1984 and 1989 cohorts
reported as percentage of total actual change in attrition

	The effect of changes in X's	The effect of changes in B's	The effect of total expected change
Army	5%	-86%	-81%
Navy	33%	-21%	12%
Air Force	-31%	81%	50%
Marine Corps	-46%	535%	488%

FOR 1989-1994 COHORTS:

Between these years the changes in X's and B's all predict a decrease in attrition

except for the changes in X's in the Air Force. The predicted changes by the changes in

X's, changes in B's, and the total predicted changes are shown in Table 19. For example,

the decomposition technique predicts an 11 percentage point decrease in attrition while

the actual change in attrition is 2.7 percentage points. 13.7 percentage point difference

between the predicted change and the actual change can not be explained by the

technique. Table 20 reports the predicted changes in terms of percentages of actual

changes that took place between these years.

Table C.19
Summary of decomposition analysis
by services for 1989 and 1994 cohorts (numbers in percentage points)

	The effect of changes in X's	The effect of changes in B's	Total expected change in attrition	Actual change in attrition
Army	-0.0080	-0.0448	-0.0528	0.026
Navy	-0.0375	-0.0727	-0.1102	0.027
Air Force	0.0076	-0.0632	-0.0556	0.024
Marine Corps	-0.0037	-0.0982	-0.1019	0.008

Table C.20
Summary of decomposition analysis for 1989 and 1994 cohorts
reported as percentage of total actual change in attrition

	The effect of changes in X's	The effect of changes in B's	The effect of total expected change
Army	-31%	-172%	-203%
Navy	-139%	-269%	-408%
Air Force	32%	-263%	-232%
Marine Corps	-46%	-1228%	-1274%

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APPENDIX D. OVERALL CHANGES IN ATTRITION DUE TO CHANGES IN X'S AND CHANGES IN B'S, WITH INDIVIDUALS WHO HAVE "SOME HIGHER EDUCATION" IN THE SAMPLES

This appendix presents the results of decomposition analysis for all four services and entry cohorts 1984, 1989, and 1994 by including the individuals who have "some higher education." Higher education comprises college dropouts, college graduates, and individuals with master's or doctoral degrees. Since this group has lower attrition rates than non-high school diploma graduates/G.E.D. holders and high school diploma graduates, the samples which include this group naturally have lower attrition rates than those that do not include this group. That is, the actual attrition rates presented in Chapter IV slightly decrease because of the inclusion of this group. The rest of the appendix presents the results of the decomposition technique with respect to services and entry cohorts.

Note: The sum of expected changes in attrition due to changes in each X or marginal effect may not equal the total expected changes given in each table due to rounding.

A. ARMY

Application of decomposition technique to Army 1984 and 1989 cohorts

Estimated change in attrition due to change in X's = 0.0065 (Table 1)

Estimated change in attrition due to change in B's = -0.0269 (Table 2)

Total estimated change in attrition between these years = -0.0204

The actual change in attrition between these years = 0.0370

Difference between the actual and the estimated = 0.0574

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.1
Expected changes in Army attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1479	0.136	0.143	0.006	0.0010	0.02
Black	-0.0890	0.237	0.277	0.040	-0.0035	-0.09
Hisp	-0.0926	0.037	0.058	0.021	-0.0019	-0.05
Other	-0.0726	0.032	0.031	-0.001	0.0000	0.00
NHGEDCRE	0.2252	0.102	0.129	0.027	0.0060	**0.16**
HIGHEDUC	-0.0677	0.089	0.021	-0.068	0.0046	**0.12**
Age17	0.0321	0.074	0.065	-0.008	-0.0002	0.00
Age19	0.0129	0.217	0.234	0.017	0.0002	0.00
Age20	0.0023	0.119	0.126	0.007	0.0000	0.00
Age21	0.0146	0.070	0.072	0.002	0.0000	0.00
Age22	0.0272	0.048	0.048	0.000	0.0000	0.00
Age23+	0.0588	0.123	0.118	-0.005	-0.0002	0.00
AFQTPRCT	-0.0011	53.37	54.37	1.00	-0.0011	-0.03
Depmos	-0.0074	3.63	3.40	-0.23	0.0017	0.04
Total Expected Change =					**0.0065**	

Table D.2

Expected changes in Army attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / change / diff. in att.
Female	0.1480	0.1530	0.0050	0.136	0.143	0.140	0.0007	0.01
Black	-0.0891	-0.0913	-0.0022	0.237	0.277	0.257	-0.0006	-0.02
Hisp	-0.0927	-0.1143	-0.0216	0.037	0.058	0.048	-0.0010	-0.03
Other	-0.0727	-0.0829	-0.0102	0.032	0.031	0.032	-0.0003	-0.01
NHGEDCRE	0.2252	0.1947	-0.0305	0.102	0.129	0.116	-0.0035	-0.10
HIGHEDUC	-0.0678	-0.0409	0.0269	0.089	0.021	0.055	0.0015	0.03
Age17	0.0322	0.0219	-0.0103	0.074	0.065	0.070	-0.0007	-0.02
Age19	0.0130	0.0028	-0.0102	0.217	0.234	0.226	-0.0023	-0.06
Age20	0.0023	0.0029	0.0005	0.119	0.126	0.123	0.0001	0.00
Age21	0.0147	0.0066	-0.0081	0.070	0.072	0.071	-0.0006	-0.02
Age22	0.0272	0.0101	-0.0171	0.048	0.048	0.048	-0.0008	-0.02
Age23+	0.0588	0.0035	-0.0553	0.123	0.118	0.121	-0.0067	-0.18
AFQTPRCT	-0.0011	-0.0015	-0.0003	53.37	54.37	53.87	-0.0178	-0.48
Depmos	-0.0074	-0.0059	0.0015	3.63	3.40	3.52	0.0052	0.13

Total Expected Change = -0.0269

Application of decomposition technique to Army 1984 and 1994 cohorts

Estimated change in attrition due to change in X's   = -0.0012 (Table 3)

Estimated change in attrition due to change in B's   = -0.0729 (Table 4)

Total estimated change in attrition between these years = -0.0741

The actual change in attrition between these years   = 0.0600

Difference between the actual and the estimated   = 0.1341

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.3
Expected changes in Army attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1480	0.136	0.181	0.045	0.0067	**0.11**
Black	-0.0891	0.237	0.232	-0.005	0.0004	0.01
Hisp	-0.0927	0.037	0.074	0.037	-0.0034	-0.06
Other	-0.0727	0.032	0.037	0.005	-0.0004	-0.01
NHGEDCRE	0.2252	0.102	0.078	-0.024	-0.0054	**-0.09**
HIGHEDUC	-0.0678	0.089	0.037	-0.052	0.0035	0.06
Age17	0.0322	0.074	0.041	-0.033	-0.0011	-0.02
Age19	0.0130	0.217	0.235	0.018	0.0002	0.00
Age20	0.0023	0.119	0.143	0.024	0.0001	0.00
Age21	0.0147	0.070	0.090	0.020	0.0003	0.00
Age22	0.0272	0.048	0.062	0.014	0.0004	0.01
Age23+	0.0588	0.123	0.144	0.021	0.0012	0.02
AFQTPRCT	-0.0011	53.37	58.28	4.91	-0.0056	**-0.09**
Depmos	-0.0074	3.63	3.38	-0.25	0.0019	0.03
Total Expected Change =					**-0.0012**	

Table D.4

Expected changes in Army attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1480	0.1370	-0.0110	0.136	0.181	0.159	-0.0017	-0.03
Black	-0.0891	-0.0847	0.0043	0.237	0.232	0.235	0.0010	0.02
Hisp	-0.0927	-0.1358	-0.0431	0.037	0.074	0.056	-0.0024	-0.04
Other	-0.0727	-0.1279	-0.0553	0.032	0.037	0.035	-0.0019	-0.03
NHGEDCRE	0.2252	0.1582	-0.0670	0.102	0.078	0.090	-0.0060	-0.10
HIGHEDUC	-0.0678	-0.0686	-0.0008	0.089	0.037	0.063	-0.0001	0.00
Age17	0.0322	0.0089	-0.0233	0.074	0.041	0.058	-0.0013	-0.02
Age19	0.0130	0.0014	-0.0116	0.217	0.235	0.226	-0.0026	-0.04
Age20	0.0023	0.0035	0.0012	0.119	0.143	0.131	0.0002	0.00
Age21	0.0147	0.0044	-0.0102	0.070	0.090	0.080	-0.0008	-0.01
Age22	0.0272	-0.0067	-0.0340	0.048	0.062	0.055	-0.0019	-0.03
Age23+	0.0588	-0.0204	-0.0792	0.123	0.144	0.134	-0.0106	-0.18
AFQTPRCT	-0.0011	-0.0022	-0.0010	53.37	58.28	55.83	-0.0581	-0.97
Depmos	-0.0074	-0.0036	0.0038	3.63	3.38	3.51	0.0133	0.22

Total Expected Change = -0.0729

Application of decomposition technique to Army 1989 and 1994 cohorts

Estimated change in attrition due to change in X's   = -0.0087   (Table 5)

Estimated change in attrition due to change in B's   = -0.0457   (Table 6)

Total estimated change in attrition between these years   = -0.0544

The actual change in attrition between these years   = 0.0230

Difference between the actual and the estimated   = 0.0744

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.5
Expected changes in Army attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1530	0.143	0.181	0.038	0.0058	**0.25**
Black	-0.0913	0.277	0.232	-0.045	0.0041	0.18
Hisp	-0.1143	0.058	0.074	0.016	-0.0018	-0.08
Other	-0.0829	0.031	0.037	0.006	-0.0005	-0.02
NHGEDCRE	0.1947	0.129	0.078	-0.051	-0.0099	**-0.43**
HIGHEDUC	-0.0409	0.021	0.037	0.016	-0.0007	-0.03
Age17	0.0219	0.065	0.041	-0.024	-0.0005	-0.02
Age19	0.0028	0.234	0.235	0.001	0.0000	0.00
Age20	0.0029	0.126	0.143	0.017	0.0000	0.00
Age21	0.0066	0.072	0.090	0.018	0.0001	0.01
Age22	0.0101	0.048	0.062	0.014	0.0001	0.01
Age23+	0.0035	0.118	0.144	0.026	0.0001	0.00
AFQTPRCT	-0.0015	54.37	58.28	3.91	-0.0057	**-0.25**
Depmos	-0.0059	3.40	3.38	-0.02	0.0001	0.01
Total Expected Change =					**-0.0087**	

Table D.6

Expected changes in Army attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1530	0.1370	-0.0160	0.143	0.181	0.162	-0.0026	-0.11
Black	-0.0913	-0.0847	0.0065	0.277	0.232	0.255	0.0017	0.07
Hisp	-0.1143	-0.1358	-0.0215	0.058	0.074	0.066	-0.0014	-0.06
Other	-0.0829	-0.1279	-0.0451	0.031	0.037	0.034	-0.0015	-0.07
NHGEDCRE	0.1947	0.1582	-0.0365	0.129	0.078	0.104	-0.0038	-0.16
HIGHEDUC	-0.0409	-0.0686	-0.0277	0.021	0.037	0.029	-0.0008	-0.03
Age17	0.0219	0.0089	-0.0130	0.065	0.041	0.053	-0.0007	-0.03
Age19	0.0028	0.0014	-0.0014	0.234	0.235	0.235	-0.0003	-0.01
Age20	0.0029	0.0035	0.0006	0.126	0.143	0.135	0.0001	0.00
Age21	0.0066	0.0044	-0.0022	0.072	0.090	0.081	-0.0002	-0.01
Age22	0.0101	-0.0067	-0.0169	0.048	0.062	0.055	-0.0009	-0.04
Age23+	0.0035	-0.0204	-0.0239	0.118	0.144	0.131	-0.0031	-0.14
AFQTPRCT	-0.0015	-0.0022	-0.0007	54.37	58.28	56.33	-0.0400	-1.74
Depmos	-0.0059	-0.0036	0.0023	3.40	3.38	3.39	0.0079	0.34

Total Expected Change = -0.0457

B. NAVY

Application of decomposition technique to Navy 1984 and 1989 cohorts

Estimated change in attrition due to change in X's   = 0.0304   (Table 7)

Estimated change in attrition due to change in B's   = -0.0185   (Table 8)

Total estimated change in attrition between these years = 0.0119

The actual change in attrition between these years   = 0.0850

Difference between the actual and the estimated   = 0.0969
changes in attrition which is unexplained by the
decomposition (in absolute terms)

Table D.7
Expected changes in Navy attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0685	0.115	0.134	0.019	0.0013	0.02
Black	-0.0288	0.143	0.202	0.059	-0.0017	-0.02
Hisp	-0.0216	0.054	0.079	0.025	-0.0005	-0.01
Other	-0.0758	0.028	0.031	0.003	-0.0002	0.00
NHGEDCRE	0.2194	0.070	0.130	0.060	0.0132	**0.15**
HIGHEDUC	-0.0554	0.087	0.015	-0.072	0.0040	0.05
Age17	0.0210	0.050	0.067	0.017	0.0004	0.00
Age19	0.0042	0.236	0.235	-0.001	0.0000	0.00
Age20	0.0102	0.130	0.115	-0.015	-0.0002	0.00
Age21	0.0018	0.080	0.064	-0.016	0.0000	0.00
Age22	0.0147	0.053	0.042	-0.011	-0.0002	0.00
Age23+	0.0367	0.132	0.109	-0.023	-0.0008	-0.01
AFQTPRCT	-0.0017	58.87	57.38	-1.49	0.0025	0.03
Depmos	-0.0090	5.54	4.12	-1.42	0.0128	**0.15**
Total Expected Change =					**0.0304**	

Table D.8
Expected changes in Navy attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0685	0.0864	0.0179	0.115	0.134	0.125	0.0022	0.03
Black	-0.0288	-0.0370	-0.0082	0.143	0.202	0.173	-0.0014	-0.02
Hisp	-0.0216	-0.0503	-0.0287	0.054	0.079	0.067	-0.0019	-0.02
Other	-0.0758	-0.1384	-0.0626	0.028	0.031	0.030	-0.0018	-0.02
NHGEDCRE	0.2194	0.2088	-0.0106	0.070	0.130	0.100	-0.0011	-0.01
HIGHEDUC	-0.0554	-0.0502	0.0052	0.087	0.015	0.051	0.0003	0.00
Age17	0.0210	0.0378	0.0168	0.050	0.067	0.059	0.0010	0.01
Age19	0.0042	0.0128	0.0086	0.236	0.235	0.236	0.0020	0.02
Age20	0.0102	0.0048	-0.0054	0.130	0.115	0.123	-0.0007	-0.01
Age21	0.0018	0.0053	0.0035	0.080	0.064	0.072	0.0003	0.00
Age22	0.0147	0.0168	0.0021	0.053	0.042	0.048	0.0001	0.00
Age23+	0.0367	0.0323	-0.0044	0.132	0.109	0.121	-0.0005	-0.01
AFQTPRCT	-0.0017	-0.0017	0.0000	58.87	57.38	58.13	-0.0023	-0.03
Depmos	-0.0090	-0.0121	-0.0030	5.54	4.12	4.83	-0.0147	**-0.17**

Total Expected Change = **-0.0185**

Application of decomposition technique to Navy 1984 and 1994 cohorts

Estimated change in attrition due to change in X's   = -0.0046 (Table 9)

Estimated change in attrition due to change in B's   = -0.0965 (Table 10)

Total estimated change in attrition between these years = -0.1011

The actual change in attrition between these years   = 0.1090

Difference between the actual and the estimated   = 0.2101

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.9
Expected changes in Navy attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0685	0.115	0.169	0.054	0.0037	0.03
Black	-0.0288	0.143	0.157	0.014	-0.0004	0.00
Hisp	-0.0216	0.054	0.073	0.019	-0.0004	0.00
Other	-0.0758	0.028	0.040	0.012	-0.0009	-0.01
NHGEDCRE	0.2194	0.070	0.061	-0.009	-0.0020	-0.02
HIGHEDUC	-0.0554	0.087	0.021	-0.066	0.0037	0.03
Age17	0.0210	0.050	0.039	-0.011	-0.0002	0.00
Age19	0.0042	0.236	0.247	0.011	0.0000	0.00
Age20	0.0102	0.130	0.134	0.004	0.0000	0.00
Age21	0.0018	0.080	0.074	-0.006	0.0000	0.00
Age22	0.0147	0.053	0.049	-0.004	-0.0001	0.00
Age23+	0.0367	0.132	0.102	-0.030	-0.0011	-0.01
AFQTPRCT	-0.0017	58.87	64.72	5.85	-0.0097	**-0.09**
Depmos	-0.0090	5.54	5.23	-0.31	0.0028	0.03
Total Expected Change =					**-0.0046**	

118

Table D.10
Expected changes in Navy attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0685	0.0286	-0.0399	0.115	0.169	0.142	-0.0057	-0.05
Black	-0.0288	-0.0192	0.0096	0.143	0.157	0.150	0.0014	0.01
Hisp	-0.0216	-0.0910	-0.0694	0.054	0.073	0.064	-0.0044	-0.04
Other	-0.0758	-0.1590	-0.0833	0.028	0.040	0.034	-0.0028	-0.03
NHGEDCRE	0.2194	0.1653	-0.0541	0.070	0.061	0.066	-0.0035	-0.03
HIGHEDUC	-0.0554	-0.0881	-0.0328	0.087	0.021	0.054	-0.0018	-0.02
Age17	0.0210	-0.0090	-0.0300	0.050	0.039	0.045	-0.0013	-0.01
Age19	0.0042	-0.0062	-0.0104	0.236	0.247	0.242	-0.0025	-0.02
Age20	0.0102	-0.0067	-0.0169	0.130	0.134	0.132	-0.0022	-0.02
Age21	0.0018	-0.0198	-0.0216	0.080	0.074	0.077	-0.0017	-0.02
Age22	0.0147	-0.0241	-0.0387	0.053	0.049	0.051	-0.0020	-0.02
Age23+	0.0367	-0.0196	-0.0562	0.132	0.102	0.117	-0.0066	-0.06
AFQTPRCT	-0.0017	-0.0023	-0.0006	58.87	64.72	61.80	-0.0377	-0.35
Depmos	-0.0090	-0.0138	-0.0048	5.54	5.23	5.39	-0.0258	-0.24
						Total Expected Change =		-0.0965

119

Application of decomposition technique to Navy 1989 and 1994 cohorts

Estimated change in attrition due to change in X's $\quad = -0.0377$ (Table 11)

Estimated change in attrition due to change in B's $\quad = -0.0747$ (Table 12)

Total estimated change in attrition between these years $= -0.1124$

The actual change in attrition between these years $\quad = 0.0240$

Difference between the actual and the estimated $\quad = 0.1364$

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.11
Expected changes in Navy attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.0864	0.134	0.169	0.035	0.0030	0.13
Black	-0.0370	0.202	0.157	-0.045	0.0017	0.07
Hisp	-0.0503	0.079	0.073	-0.006	0.0003	0.01
Other	-0.1384	0.031	0.040	0.009	-0.0012	-0.05
NHGEDCRE	0.2088	0.130	0.061	-0.069	-0.0144	**-0.60**
HIGHEDUC	-0.0502	0.015	0.021	0.006	-0.0003	-0.01
Age17	0.0378	0.067	0.039	-0.028	-0.0011	-0.04
Age19	0.0128	0.235	0.247	0.012	0.0002	0.01
Age20	0.0048	0.115	0.134	0.019	0.0001	0.00
Age21	0.0053	0.064	0.074	0.010	0.0001	0.00
Age22	0.0168	0.042	0.049	0.007	0.0001	0.00
Age23+	0.0323	0.109	0.102	-0.007	-0.0002	-0.01
AFQTPRCT	-0.0017	57.38	64.72	7.34	-0.0125	**-0.52**
Depmos	-0.0121	4.12	5.23	1.11	-0.0134	**-0.56**
Total Expected Change =					**-0.0377**	

Table D.12
Expected changes in Navy attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0864	0.0286	-0.0579	0.134	0.169	0.152	-0.0088	-0.37
Black	-0.0370	-0.0192	0.0178	0.202	0.157	0.180	0.0032	0.13
Hisp	-0.0503	-0.0910	-0.0407	0.079	0.073	0.076	-0.0031	-0.13
Other	-0.1384	-0.1590	-0.0207	0.031	0.040	0.036	-0.0007	-0.03
NHGEDCRE	0.2088	0.1653	-0.0435	0.130	0.061	0.096	-0.0042	-0.17
HIGHEDUC	-0.0502	-0.0881	-0.0379	0.015	0.021	0.018	-0.0007	-0.03
Age17	0.0378	-0.0090	-0.0468	0.067	0.039	0.053	-0.0025	-0.10
Age19	0.0128	-0.0062	-0.0190	0.235	0.247	0.241	-0.0046	-0.19
Age20	0.0048	-0.0067	-0.0115	0.115	0.134	0.125	-0.0014	-0.06
Age21	0.0053	-0.0198	-0.0251	0.064	0.074	0.069	-0.0017	-0.07
Age22	0.0168	-0.0241	-0.0409	0.042	0.049	0.046	-0.0019	-0.08
Age23+	0.0323	-0.0196	-0.0519	0.109	0.102	0.106	-0.0055	-0.23
AFQTPRCT	-0.0017	-0.0023	-0.0006	57.38	64.72	61.05	-0.0348	-1.45
Depmos	-0.0121	-0.0138	-0.0017	4.12	5.23	4.68	-0.0082	-0.34

Total Expected Change = **-0.0747**

C.   AIR FORCE

Application of decomposition technique to Air Force 1984 and 1989 cohorts

Estimated change in attrition due to change in X's   = -0.0019 (Table 13)

Estimated change in attrition due to change in B's   = 0.0380 (Table 14)

Total estimated change in attrition between these years = 0.0361

The actual change in attrition between these years   = 0.0510

Difference between the actual and the estimated   = 0.0149

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.13
Expected changes in Air Force attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0861	0.151	0.213	0.062	0.0053	0.10
Black	-0.0295	0.137	0.126	-0.011	0.0003	0.01
Hisp	-0.0733	0.024	0.034	0.010	-0.0007	-0.01
Other	-0.0611	0.027	0.027	0.000	0.0000	0.00
NHGEDCRE	0.1995	0.011	0.010	-0.001	-0.0002	0.00
HIGHEDUC	-0.0444	0.165	0.021	-0.144	0.0064	0.13
Age17	0.0241	0.037	0.028	-0.009	-0.0002	0.00
Age19	-0.0028	0.234	0.250	0.016	0.0000	0.00
Age20	-0.0234	0.146	0.132	-0.014	0.0003	0.01
Age21	-0.0292	0.095	0.079	-0.016	0.0005	0.01
Age22	-0.0368	0.064	0.051	-0.013	0.0005	0.01
Age23+	-0.0224	0.120	0.104	-0.016	0.0004	0.01
AFQTPRCT	-0.0015	62.89	66.20	3.31	-0.0051	-0.10
Depmos	-0.0091	4.83	5.86	1.03	-0.0093	**-0.18**
Total Expected Change =					**-0.0019**	

Table D.14
Expected changes in Air Force attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0861	0.1203	0.0342	0.151	0.213	0.182	0.0062	0.12
Black	-0.0295	-0.0709	-0.0414	0.137	0.126	0.132	-0.0054	-0.11
Hisp	-0.0733	-0.0796	-0.0064	0.024	0.034	0.029	-0.0002	0.00
Other	-0.0611	-0.0810	-0.0198	0.027	0.027	0.027	-0.0005	-0.01
NHGEDCRE	0.1995	0.1606	-0.0390	0.011	0.010	0.011	-0.0004	-0.01
HIGHEDUC	-0.0444	-0.0300	0.0144	0.165	0.021	0.093	0.0013	0.03
Age17	0.0241	0.0064	-0.0178	0.037	0.028	0.033	-0.0006	-0.01
Age19	-0.0028	0.0058	0.0086	0.234	0.250	0.242	0.0021	0.04
Age20	-0.0234	-0.0142	0.0092	0.146	0.132	0.139	0.0013	0.03
Age21	-0.0292	-0.0225	0.0067	0.095	0.079	0.087	0.0006	0.01
Age22	-0.0368	-0.0375	-0.0007	0.064	0.051	0.058	0.0000	0.00
Age23+	-0.0224	-0.0431	-0.0207	0.120	0.104	0.112	-0.0023	-0.05
AFQTPRCT	-0.0015	-0.0013	0.0003	62.89	66.20	64.55	0.0181	**0.35**
Depmos	-0.0091	-0.0057	0.0034	4.83	5.86	5.35	0.0180	**0.35**

Total Expected Change = **0.0380**

Application of decomposition technique to Air Force 1984 and 1994 cohorts

Estimated change in attrition due to change in X's   = 0.0092 (Table 15)

Estimated change in attrition due to change in B's   = -0.0262 (Table 16)

Total estimated change in attrition between these years = -0.0170

The actual change in attrition between these years   = 0.0760

Difference between the actual and the estimated   = 0.0930

changes in attrition which is unexplained by the decomposition (in absolute

terms)

Table D.15
Expected changes in Air Force attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.0861	0.151	0.238	0.087	0.0075	**0.10**
Black	-0.0295	0.137	0.142	0.005	-0.0001	0.00
Hisp	-0.0733	0.024	0.048	0.024	-0.0018	-0.02
Other	-0.0611	0.027	0.041	0.014	-0.0009	-0.01
NHGEDCRE	0.1995	0.011	0.014	0.003	0.0006	0.01
HIGHEDUC	-0.0444	0.165	0.021	-0.144	0.0064	**0.08**
Age17	0.0241	0.037	0.030	-0.007	-0.0002	0.00
Age19	-0.0028	0.234	0.255	0.021	-0.0001	0.00
Age20	-0.0234	0.146	0.146	0.000	0.0000	0.00
Age21	-0.0292	0.095	0.087	-0.008	0.0002	0.00
Age22	-0.0368	0.064	0.059	-0.005	0.0002	0.00
Age23+	-0.0224	0.120	0.092	-0.028	0.0006	0.01
AFQTPRCT	-0.0015	62.89	65.32	2.43	-0.0037	-0.05
Depmos	-0.0091	4.83	4.78	-0.05	0.0005	0.01
Total Expected Change =					**0.0092**	

124

Table D.16
Expected changes in Air Force attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.0861	0.0697	-0.0164	0.151	0.238	0.195	-0.0032	-0.04
Black	-0.0295	-0.0270	0.0025	0.137	0.142	0.140	0.0004	0.00
Hisp	-0.0733	-0.1014	-0.0281	0.024	0.048	0.036	-0.0010	-0.01
Other	-0.0611	-0.0761	-0.0150	0.027	0.041	0.034	-0.0005	-0.01
NHGEDCRE	0.1995	0.0693	-0.1303	0.011	0.014	0.013	-0.0016	-0.02
HIGHEDUC	-0.0444	-0.0441	0.0003	0.165	0.021	0.093	0.0000	0.00
Age17	0.0241	0.0207	-0.0034	0.037	0.030	0.034	-0.0001	0.00
Age19	-0.0028	-0.0041	-0.0013	0.234	0.255	0.245	-0.0003	0.00
Age20	-0.0234	-0.0162	0.0073	0.146	0.146	0.146	0.0011	0.01
Age21	-0.0292	-0.0485	-0.0193	0.095	0.087	0.091	-0.0018	-0.02
Age22	-0.0368	-0.0302	0.0066	0.064	0.059	0.062	0.0004	0.01
Age23+	-0.0224	-0.0404	-0.0181	0.120	0.092	0.106	-0.0019	-0.03
AFQTPRCT	-0.0015	-0.0021	-0.0005	62.89	65.32	64.11	-0.0340	**-0.45**
Depmos	-0.0091	-0.0057	0.0034	4.83	4.78	4.81	0.0163	**0.21**

Total Expected Change = **-0.0262**

Application of decomposition technique to Air Force 1989 and 1994 cohorts

Estimated change in attrition due to change in X's = 0.0074 (Table 17)

Estimated change in attrition due to change in B's = -0.0646 (Table 18)

Total estimated change in attrition between these years = -0.0572

The actual change in attrition between these years = 0.0250

Difference between the actual and the estimated = 0.0822

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.17
Expected changes in Air Force attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1203	0.213	0.238	0.025	0.0030	0.12
Black	-0.0709	0.126	0.142	0.016	-0.0011	-0.05
Hisp	-0.0796	0.034	0.048	0.014	-0.0011	-0.04
Other	-0.0810	0.027	0.041	0.014	-0.0011	-0.05
NHGEDCRE	0.1606	0.010	0.014	0.004	0.0006	0.03
HIGHEDUC	-0.0300	0.021	0.021	0.000	0.0000	0.00
Age17	0.0064	0.028	0.030	0.002	0.0000	0.00
Age19	0.0058	0.250	0.255	0.005	0.0000	0.00
Age20	-0.0142	0.132	0.146	0.014	-0.0002	-0.01
Age21	-0.0225	0.079	0.087	0.008	-0.0002	-0.01
Age22	-0.0375	0.051	0.059	0.008	-0.0003	-0.01
Age23+	-0.0431	0.104	0.092	-0.012	0.0005	0.02
AFQTPRCT	-0.0013	66.20	65.32	-0.88	0.0011	0.04
Depmos	-0.0057	5.86	4.78	-1.08	0.0062	**0.25**
Total Expected Change =					**0.0074**	

Table D.18

Expected changes in Air Force attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1203	0.0697	-0.0506	0.213	0.238	0.226	-0.0114	-0.46
Black	-0.0709	-0.0270	0.0439	0.126	0.142	0.134	0.0059	0.24
Hisp	-0.0796	-0.1014	-0.0217	0.034	0.048	0.041	-0.0009	-0.04
Other	-0.0810	-0.0761	0.0048	0.027	0.041	0.034	0.0002	0.01
NHGEDCRE	0.1606	0.0693	-0.0913	0.010	0.014	0.012	-0.0011	-0.04
HIGHEDUC	-0.0300	-0.0441	-0.0141	0.021	0.021	0.021	-0.0003	-0.01
Age17	0.0064	0.0207	0.0143	0.028	0.030	0.029	0.0004	0.02
Age19	0.0058	-0.0041	-0.0098	0.250	0.255	0.253	-0.0025	-0.10
Age20	-0.0142	-0.0162	-0.0020	0.132	0.146	0.139	-0.0003	-0.01
Age21	-0.0225	-0.0485	-0.0260	0.079	0.087	0.083	-0.0022	-0.09
Age22	-0.0375	-0.0302	0.0073	0.051	0.059	0.055	0.0004	0.02
Age23+	-0.0431	-0.0404	0.0027	0.104	0.092	0.098	0.0003	0.01
AFQTPRCT	-0.0013	-0.0021	-0.0008	66.20	65.32	65.76	-0.0533	-2.13
Depmos	-0.0057	-0.0057	0.0000	5.86	4.78	5.32	0.0001	0.00

Total Expected Change =   -0.0646

D.   MARINE CORPS

Application of decomposition technique to Marine Corps 1984 and 1989

Estimated change in attrition due to change in X's   = -0.0021   (Table 19)

Estimated change in attrition due to change in B's   = 0.0598   (Table 20)

Total estimated change in attrition between these years = 0.0577

The actual change in attrition between these years   = 0.0130

Difference between the actual and the estimated   = 0.0447

changes in attrition which is unexplained by the decomposition (in absolute

terms)

Table D.19
Expected changes in Marine Corps attrition 1984-1989 due to change in X's

	Marginal effects in 1984	X 84	X 89	X 89 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1558	0.054	0.066	0.012	0.0019	0.14
Black	-0.0298	0.173	0.194	0.021	-0.0006	-0.05
Hisp	-0.0830	0.037	0.081	0.044	-0.0037	-0.28
Other	-0.0564	0.036	0.036	0.000	0.0000	0.00
NHGEDCRE	0.2286	0.049	0.071	0.022	0.0050	**0.39**
HIGHEDUC	-0.0704	0.053	0.007	-0.046	0.0032	0.25
Age17	0.0249	0.073	0.060	-0.013	-0.0003	-0.02
Age19	0.0069	0.237	0.269	0.032	0.0002	0.02
Age20	0.0008	0.094	0.099	0.005	0.0000	0.00
Age21	0.0273	0.051	0.047	-0.004	-0.0001	-0.01
Age22	0.0346	0.031	0.025	-0.006	-0.0002	-0.02
Age23+	0.0599	0.052	0.042	-0.010	-0.0006	-0.05
AFQTPRCT	-0.0018	54.76	55.67	0.91	-0.0017	-0.13
Depmos	-0.0107	5.36	5.86	0.50	-0.0053	**-0.41**
Total Expected Change =					**-0.0021**	

Table D.20

Expected changes in Marine Corps attrition 1984-1989 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1989	Change in Marginal effects	X 84	X 89	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1558	0.1921	0.0363	0.054	0.066	0.060	0.0022	0.17
Black	-0.0298	0.0066	0.0365	0.173	0.194	0.184	0.0067	0.51
Hisp	-0.0830	-0.0866	-0.0036	0.037	0.081	0.059	-0.0002	-0.02
Other	-0.0564	-0.0518	0.0047	0.036	0.036	0.036	0.0002	0.01
NHGEDCRE	0.2286	0.1545	-0.0741	0.049	0.071	0.060	-0.0044	-0.34
HIGHEDUC	-0.0704	-0.1547	-0.0843	0.053	0.007	0.030	-0.0025	-0.19
Age17	0.0249	0.0149	-0.0100	0.073	0.060	0.067	-0.0007	-0.05
Age19	0.0069	0.0188	0.0119	0.237	0.269	0.253	0.0030	0.23
Age20	0.0008	0.0215	0.0207	0.094	0.099	0.097	0.0020	0.15
Age21	0.0273	0.0358	0.0085	0.051	0.047	0.049	0.0004	0.03
Age22	0.0346	0.0374	0.0028	0.031	0.025	0.028	0.0001	0.01
Age23+	0.0599	0.1148	0.0549	0.052	0.042	0.047	0.0026	0.20
AFQTPRCT	-0.0018	-0.0012	0.0006	54.76	55.67	55.22	0.0326	2.51
Depmos	-0.0107	-0.0075	0.0032	5.36	5.86	5.61	0.0180	1.39

Total Expected Change =   0.0598

Application of decomposition technique to Marine Corps 1984 and 1994 cohorts

Estimated change in attrition due to change in X's   = -0.0054   (Table 21)

Estimated change in attrition due to change in B's   = -0.0369   (Table 22)

Total estimated change in attrition between these years   = -0.0423

The actual change in attrition between these years   = 0.0210

Difference between the actual and the estimated   = 0.0633

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.21
Expected changes in Marine Corps attrition 1984-1994 due to change in X's

	Marginal effects in 1984	X 84	X 94	X 94 - X 84	Expected change in attrition	Expected change / diff. in att.
Female	0.1558	0.054	0.055	0.001	0.0002	0.01
Black	-0.0298	0.173	0.130	-0.043	0.0013	0.06
Hisp	-0.0830	0.037	0.111	0.074	-0.0061	**-0.29**
Other	-0.0564	0.036	0.035	-0.001	0.0001	0.00
NHGEDCRE	0.2286	0.049	0.050	0.001	0.0002	0.01
HIGHEDUC	-0.0704	0.053	0.009	-0.044	0.0031	0.15
Age17	0.0249	0.073	0.047	-0.026	-0.0006	-0.03
Age19	0.0069	0.237	0.275	0.038	0.0003	0.01
Age20	0.0008	0.094	0.123	0.029	0.0000	0.00
Age21	0.0273	0.051	0.060	0.009	0.0002	0.01
Age22	0.0346	0.031	0.036	0.005	0.0002	0.01
Age23+	0.0599	0.052	0.054	0.002	0.0001	0.01
AFQTPRCT	-0.0018	54.76	57.58	2.82	-0.0051	**-0.24**
Depmos	-0.0107	5.36	5.28	-0.08	0.0009	0.04
Total Expected Change =					**-0.0054**	

Table D.22
Expected changes in Marine Corps attrition 1984-1994 due to change in Marginal Effects

	Marginal effects in 1984	Marginal effects in 1994	Change in Marginal effects	X 84	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1558	0.1135	-0.0423	0.054	0.055	0.055	-0.0023	-0.11
Black	-0.0298	-0.0198	0.0101	0.173	0.130	0.152	0.0015	0.07
Hisp	-0.0830	-0.1130	-0.0300	0.037	0.111	0.074	-0.0022	-0.11
Other	-0.0564	-0.0725	-0.0161	0.036	0.035	0.036	-0.0006	-0.03
NHGEDCRE	0.2286	0.1402	-0.0885	0.049	0.050	0.050	-0.0044	-0.21
HIGHEDUC	-0.0704	-0.0947	-0.0243	0.053	0.009	0.031	-0.0008	-0.04
Age17	0.0249	0.0264	0.0015	0.073	0.047	0.060	0.0001	0.00
Age19	0.0069	0.0066	-0.0003	0.237	0.275	0.256	-0.0001	0.00
Age20	0.0008	0.0257	0.0249	0.094	0.123	0.109	0.0027	0.13
Age21	0.0273	0.0017	-0.0257	0.051	0.060	0.056	-0.0014	-0.07
Age22	0.0346	-0.0009	-0.0355	0.031	0.036	0.034	-0.0012	-0.06
Age23+	0.0599	0.0195	-0.0403	0.052	0.054	0.053	-0.0021	-0.10
AFQTPRCT	-0.0018	-0.0022	-0.0004	54.76	57.58	56.17	-0.0202	-0.96
Depmos	-0.0107	-0.0118	-0.0011	5.36	5.28	5.32	-0.0060	-0.28
						Total Expected Change =	-0.0369	

131

Application of decomposition technique to Marine Corps 1989 and 1994 cohorts

Estimated change in attrition due to change in X's = -0.0039 (Table 23)

Estimated change in attrition due to change in B's = -0.1003 (Table 24)

Total estimated change in attrition between these years = -0.1042

The actual change in attrition between these years = 0.0080

Difference between the actual and the estimated = 0.1122

changes in attrition which is unexplained by the decomposition (in absolute terms)

Table D.23
Expected changes in Marine Corps attrition 1989-1994 due to change in X's

	Marginal effects in 1989	X 89	X 94	X 94 - X 89	Expected change in attrition	Expected change / diff. in att.
Female	0.1921	0.066	0.055	-0.011	-0.0021	-0.26
Black	0.0066	0.194	0.130	-0.064	-0.0004	-0.05
Hisp	-0.0866	0.081	0.111	0.030	-0.0026	-0.32
Other	-0.0518	0.036	0.035	-0.001	0.0001	0.01
NHGEDCRE	0.1545	0.071	0.050	-0.021	-0.0032	**-0.41**
HIGHEDUC	-0.1547	0.007	0.009	0.002	-0.0003	-0.04
Age17	0.0149	0.060	0.047	-0.013	-0.0002	-0.02
Age19	0.0188	0.269	0.275	0.006	0.0001	0.01
Age20	0.0215	0.099	0.123	0.024	0.0005	0.06
Age21	0.0358	0.047	0.060	0.013	0.0005	0.06
Age22	0.0374	0.025	0.036	0.011	0.0004	0.05
Age23+	0.1148	0.042	0.054	0.012	0.0014	0.17
AFQTPRCT	-0.0012	55.67	57.58	1.91	-0.0023	-0.29
Depmos	-0.0075	5.86	5.28	-0.58	0.0043	**0.54**
Total Expected Change =					**-0.0039**	

132

Expected changes in Marine Corps attrition 1989-1994 due to change in Marginal Effects

	Marginal effects in 1989	Marginal effects in 1994	Change in Marginal effects	X 89	X 94	Average X	Expected change in attrition	Expected change / diff. in att.
Female	0.1921	0.1135	-0.0786	0.066	0.055	0.061	-0.0048	-0.59
Black	0.0066	-0.0198	-0.0264	0.194	0.130	0.162	-0.0043	-0.53
Hisp	-0.0866	-0.1130	-0.0264	0.081	0.111	0.096	-0.0025	-0.32
Other	-0.0518	-0.0725	-0.0208	0.036	0.035	0.036	-0.0007	-0.09
NHGEDCRE	0.1545	0.1402	-0.0143	0.071	0.050	0.061	-0.0009	-0.11
HIGHEDUC	-0.1547	-0.0947	0.0600	0.007	0.009	0.008	0.0005	0.06
Age17	0.0149	0.0264	0.0115	0.060	0.047	0.054	0.0006	0.08
Age19	0.0188	0.0066	-0.0121	0.269	0.275	0.272	-0.0033	-0.41
Age20	0.0215	0.0257	0.0042	0.099	0.123	0.111	0.0005	0.06
Age21	0.0358	0.0017	-0.0341	0.047	0.060	0.054	-0.0018	-0.23
Age22	0.0374	-0.0009	-0.0383	0.025	0.036	0.031	-0.0012	-0.15
Age23+	0.1148	0.0195	-0.0952	0.042	0.054	0.048	-0.0046	-0.57
AFQTPRCT	-0.0012	-0.0022	-0.0010	55.67	57.58	56.63	-0.0538	-6.72
Depmos	-0.0075	-0.0118	-0.0043	5.86	5.28	5.57	-0.0241	-3.01

Total Expected Change = **-0.1003**

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LIST OF REFERENCES

Antel, John, James R. Hosek, and Christine E. Peterson, "Military Enlistment and Attrition: An Analysis of Decision Reversal," R-3510-FMP, June 1987.

Buddin, Richard, "Trends in Attrition of High-Quality Military Recruits," R-3539-FMP, August 1998.

Cooke, T. W., and A. O. Quester, "What Characterizes Successful Enlistees in the All-Volunteer Force: A Study of Male Recruits in the U.S. Navy," *Social Science Quarterly*, Vol. 73, pp. 238-252, June 1992.

Gujarati, D. N., Basic Econometrics, McGraw-Hill, Inc., 1995.

Mehay, Stephen L., "Alternative Methods for Analyzing First-Term Attrition in the U.S. Military," Department of Systems Management, Naval Postgraduate School, 10 June 1999. This study is a review of Cooke, T.W., Grogan, J. E., and R. T. Taggard, "A Shift Share Analysis of First-Term Attrition" (Classified), 1990.

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